A MANUAL OF AMBULANCE

J. SCOTT RIDDELL

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Method of carrying by two-handed seat.

A

MANUAL OF AMBULANCE.

BY

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ASSIST.-SURGEON, ABERDEEN ROYAL INFIRMARY; LATE ASSIST. TO THE PROFESSOR OF SURGERY, AND DEMONSTRATOR OF PRACTICAL AND OPERATIVE SURGERY, ABERDEEN UNIVERSITY; SURGEON-CAPTAIN, ABERDEEN COMPANY VOLUNTEER MEDICAL STAFF CORPS; LECTURER AND EXAMINER TO THE ABERDEEN AMBULANCE ASSOCIATION; EXAMINER TO THE ST. ANDREW'S AMBULANCE ASSOCIATION, GLASGOW, AND THE ST. JOHN AMBULANCE ASSOCIATION, LONDON.

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THIRD EDITION.

LONDON:
CHARLES GRIFFIN AND COMPANY, LIMITED;
EXETER STREET, STRAND.
1897.

"Homines ad deos nullâ re propius accedunt quam salutem hominibus dando" (Cicero).

PREFACE TO THE THIRD EDITION.

In revising the *Manual of Ambulance* for the Third Edition, several alterations and additions have been found necessary to keep the book up to date. Prominent among the latter are a Skiagram, taken by Dr. M'Kenzie Davidson, showing the position of pellets as disclosed by the Roentgen rays in a gunshot wound of the hand, and figures of the Lowmoor Jacket and the Ashford Litter. The blocks for the two last-named Illustrations were kindly lent by Colonel Sir Herbert C. Perrott, Bart., Chief Secretary of the St. John Ambulance Association.

J. SCOTT RIDDELL.

Aberdeen, *October*, 1896.

PREFACE.

A COMPLETE course of Ambulance Instruction, arranged as the experience of nearly a decade as Lecturer and Examiner has shown me to be best, will be found in these pages. The Manual is intended to serve not only for class use, but also as a means of reference in Emergency cases, and for those using the smaller text-books. It is profusely illustrated, particularly in the sections in which Anatomical and Surgical details are treated. Many of the figures have been reproduced from my *Manual of First Aid*, for which they were specially drawn by Dr. Alex. Don. The important subject of Ambulance Transport is fully discussed and illustrated.

For the information of Lecturers and Secretaries of Ambulance Classes, a chapter on Organisation and Management is added; whilst candidates entering for examination will find in the Appendix a series of Test papers on First Aid. These have been reprinted from papers set by me during the past six years for examinations conducted under the St. John, St. Andrew's, and Aberdeen Ambulance Associations.

I am greatly indebted to Messrs. Charles Griffin & Company for the use of several woodcuts from their other publications, and take this opportunity of thanking Dr. R. G. M'Kerron and Mr. D. R. Moir, M.A., for their kindness in assisting me with the revision of the proof-sheets and the preparation of the Index.

J. S. R.

ABERDEEN,
September, 1894.

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* This chapter is not required for Ambulance Examinations.

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A MANUAL OF AMBULANCE.

CHAPTER I.

OUTLINES OF HUMAN ANATOMY AND PHYSIOLOGY.

MEANING OF THE TERMS ANATOMY AND PHYSIOLOGY—THE SKELETON—BONE—A. THE CAVITIES OF THE BODY AND THEIR CONTENTS: I. THE CEREBRO-SPINAL OR HEAD AND SPINE CAVITY—THE SKULL—THE SPINE—THE BRAIN—THE SPINAL CORD—II. THE THORACIC OR CHEST CAVITY—ORGANS OF CIRCULATION—BLOOD—THE HEART—THE PULSE—SCHEME OF CIRCULATION—ORGANS OF RESPIRATION—III. THE ABDOMINAL OR STOMACH CAVITY—CONTENTS—DIGESTION—ABSORPTION—EXCRETION—B. THE EXTREMITIES OR LIMBS—JOINTS—LIGAMENTS—MUSCLES.

BEFORE the Ambulance Student can become thoroughly conversant with the *rationale* and principles of First Aid Methods, it is necessary that he should form for himself from the perusal of an initial chapter on Anatomy and Physiology a mental picture of the component parts of the human body, and that he should acquire a knowledge of the relation of these parts one to another, and of their respective functions or uses. It is not possible in a short chapter to deal exhaustively with this subject; what is overtaken here, however, is sufficient, if thoroughly mastered, to enable the student to follow with ease the methods described in the succeeding sections. A minute examination of an articulated skeleton made in conjunction with a study of the letterpress and diagrams of this chapter will greatly simplify the subject. Technical names have as far as possible been avoided. Where, however, for the sake of clearness they had to be used, popular equivalents have been given.

By **Human Anatomy** is meant the study of the structure and position of the different parts and organs of the human body, while **Physiology** deals with the functions or uses of these parts and organs. In considering the Anatomy and Physiology of the human body, the first subject that naturally attracts attention is the **Skeleton.** The skeleton consists of 214 bones, and is the frame-work or central support of the body on which the

flesh is hung, and to which the muscles are attached for purposes of movement. Viewed as a whole the skeleton is more than a mere frame-work for the support of the superstructures, for it plays a considerable part in the movements of the body, and has an important function to serve in affording protection to the vital organs of the body by forming firm bony walls for the cavities which contain them. The brain and spinal cord (nervous organs, delicate and easily injured) are safely housed in the skull and spinal column, while the chest-wall (formed by the ribs, the breast bone, and the spine) serves to protect the heart and lungs.

If from an adult skeleton we take a typical bone—*e.g.*, a thigh-bone—we find on examination that it consists of a fibrous basis impregnated with lime salts, the principal of which is phosphate of lime. These salts can be dissolved out of a bone by strong acids, leaving the fibrous basis, which is soft and easily bent, and consists of cartilage or gristle. In a young child the central frame-work is made up mainly of this cartilage or gristle, and if undue pressure be brought to bear upon it (particularly in unhealthy and improperly cared-for children, in whose bones little lime has been deposited), it readily yields, leading to the production of such deformities as "bandy legs," "knock-knees," and "curved spines." As the child grows older, lime salts are deposited in the cartilaginous basis, and it becomes solid and firm, and is known as "bone." If, however, the lime salts are not deposited in sufficient quantity, owing to improper or insufficient feeding, or bad hygienic surroundings, the bones retain to a considerable extent their cartilaginous character, and tend on injury to bend rather than to break. In the healthy adult the bones of the extremities have become firm cylinders of fibrous tissue impregnated with phosphate of lime, and if a severe strain be brought to bear upon them, they will more readily fracture than bend. In elderly people the elasticity naturally present in young bones is, to a considerable extent, lost, the bones then becoming exceedingly brittle and liable to fracture. From an examination of a dried skeleton one is apt to picture the bones as masses of dead tissue, but it should be remembered that in life the bones are liberally provided with blood, which is supplied to them through the intervention of a specially protecting and nourishing membrane known as the **periosteum.**

Fig. 1 represents the human skeleton, viewed from the front; and after full consideration of the remainder of this chapter, in which the different parts of the skeleton are dealt with *seriatim*, it is desirable that the reader should make a careful examination of the skeleton as a whole by reference to the

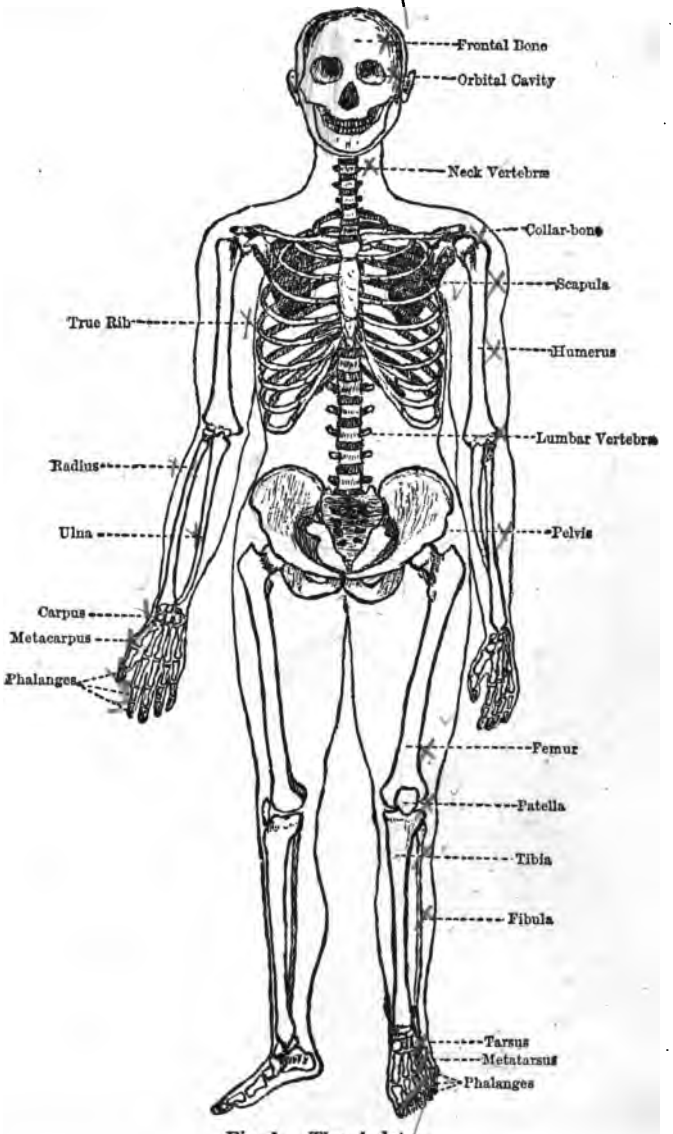


Fig. 1.—The skeleton.

diagram above-mentioned, and, if possible, to an articulated skeleton.

Fig. 2. The cerebro-spinal cavity.

For purposes of description, it will be found most convenient to consider Human Anatomy and Physiology under the following headings :—

(A) The Cavities of the Body and their Contents.

I. The Cerebro-Spinal, or Head and Spine Cavity.
II. The Thorax, or Chest Cavity.
III. The Abdomen, or Stomach Cavity.

(B) The Extremities or Limbs.

(A) *THE CAVITIES OF THE BODY AND THEIR CONTENTS.*

I. THE CEREBRO-SPINAL, OR HEAD AND SPINE CAVITY.

The Cerebro-Spinal Cavity, so called from its containing the cerebrum or brain and the spinal cord, is walled in by the bones which form the skull and the spine respectively (see Fig. 2). Dealing first with the bones of the head, we find that the skull consists of two parts :—(*a*) The brain case or cranium, formed by a number of "flat" bones, dove-tailing together at their so-called "sutures" to form a box in which the brain is enclosed, and (*b*) the bones of the face (Fig. 3).

The brain-case is formed by eight bones :—

(1) The *Frontal Bone*, anteriorly.
(2) The *Ethmoid Bone*, below it.
(3) (4) The two *Parietal Bones*, forming its upper part and sides.
(5) (6) The two *Temporal Bones*, laterally, through each of which passes the cavity of the ear.
(7) The *Occipital Bone*, posteriorly, which is perforated by a large opening known as the foramen magnum, through

which the spinal cord passes. On either side of the foramen magnum is an articular prominence or condyle (see Fig. 4), which fits into a cup on the first vertebra or segment of the spine, forming a joint there.

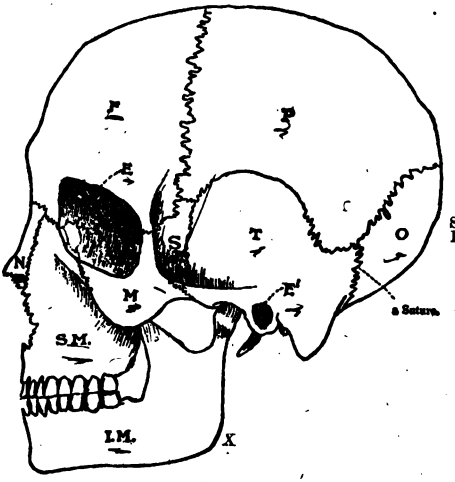


Fig. 3.—The skull.

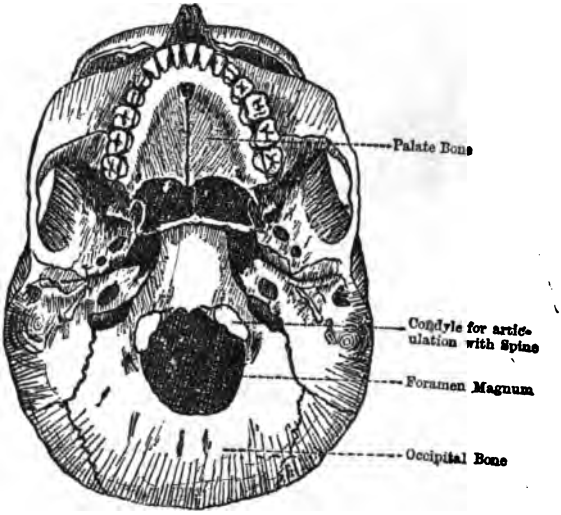


Fig. 4.—Base of skull.

(8) The *Sphenoid Bone*, which closes in the base of the skull, is pierced by a number of small openings which give exit to special nerves leaving the brain.

The face is made up of fourteen bones, the principal of which are the *Upper and Lower Maxillary or Jaw Bones*, the *Cheek Bones* (*Malars*), and the *Bones of the Nose and Palate*. Of these the lower jaw alone is movable. The bones of the face are so arranged as to form the mouth and nose cavities, and the orbital cavities for the eyes.

THE SPINE.—The spine is composed of segments, each of which is known as a *Vertebra*. It articulates above by two joints

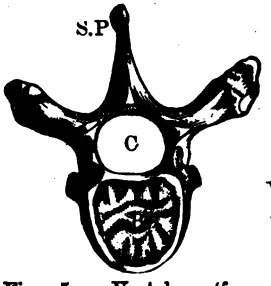


Fig. 5. — Vertebra (from above).—S.P, spinous process; C, canal for spinal cord; B, body.

Fig. 7.—Vertebra (from side).

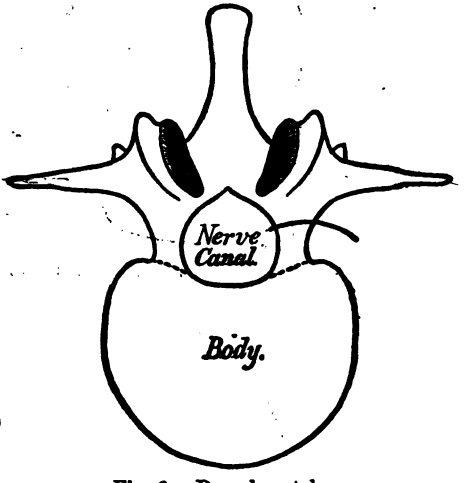


Fig. 6.—Dorsal vertebra.

with the occipital bone of the skull, while its lower end forms part of the pelvic girdle in the form of a special bone made up of five conjoined vertebræ, and known as the *Sacrum* or rump bone. The spinal vertebræ, 24 in number, are divided into three sets :—

(1) The *Neck or Cervical Vertebræ*—7 in number.
(2) The *Back or Dorsal Vertebræ*—12 in number.
(3) The *Loin or Lumbar Vertebræ*—5 in number.

Each vertebra consists of a body with processes, which are adapted for the attachment of muscles, and the protection

of the spinal cord a mass of nervous tissue easily injured, which lies within them (see Fig. 5). The ridge in the middle of the back is formed by the spinous processes of the vertebræ (see Fig. 6). Each vertebra is joined to its fellow by a disc of cartilage or gristle, and by strong bands of fibrous tissue known as ligaments. The spine, being the central column on which the body is hung, is so arranged as to be strong enough to support heavy weights, while, at the same time, in virtue of its many joints and muscular attachments, it is so pliant as to allow a very considerable range of movement.

CONTENTS OF THE CEREBRO-SPINAL CANAL.—The cerebro-spinal canal contains the brain and spinal cord, the nervous mechanism by which the sensation, the movements, and

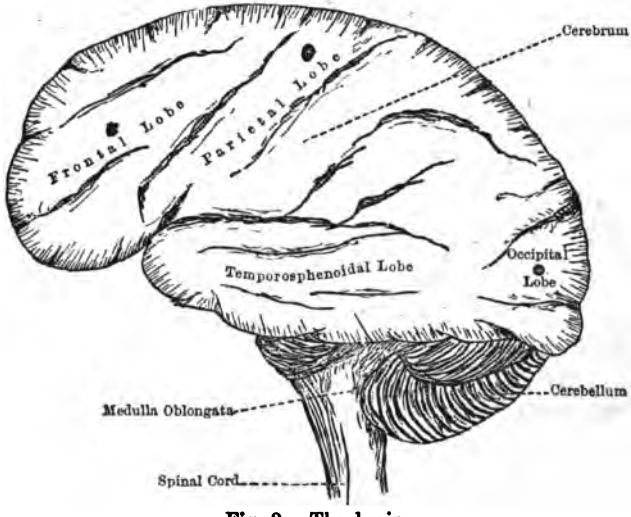


Fig. 8.—The brain.

the special functions of the body are regulated. The brain is contained in the skull, and consists of three parts :—

1. The **Cerebrum** or big brain, the organ of mind ;
2. The **Cerebellum** or little brain ; and
3. The **Medulla Oblongata.**

The brain (see Fig. 8) consists of a large number of convolutions, separated by grooves, and is divided by a number of main fissures into four main lobes—*Frontal*, *Parietal*, *Occipital*, and

Temporo-Sphenoidal—so named from the bones of the skull on which they lie. The parts of the brain which preside over the important functions of speech, movement, hearing, and sight are situated in the frontal, parietal, temporo-sphenoidal, and occipital lobes respectively. The cerebellum, or little brain, lies at the lower and back part of the skull, and has special nervous functions to fulfil, which it is unnecessary here to indicate. The medulla oblongata is a most important part of the nervous system. It lies at the junction of the brain with the spinal cord, and immediately above the opening in the skull known as the *Foramen Magnum*. The medulla oblongata contains in its substance masses of nerve cells, which are known as nerve centres, and which control special actions of the body —*e.g.*, breathing, coughing, vomiting, &c. Between the brain and the skull lie the brain-membranes, or *Meninges*, which serve to keep the brain in place, and to protect it from injury.

The Spinal Cord.—In the spinal canal formed by the conjoined vertebræ lies the spinal cord. The spinal cord (Fig. 8) consists of a large number of nerves entering and leaving the brain and conveying impulses to and from the central nervous system. The spinal cord has in its centre grey nerve-matter, round which is packed the white matter formed by the ascending and descending nerve-fibres. In the spinal cord are to be found two great classes of nerves :—

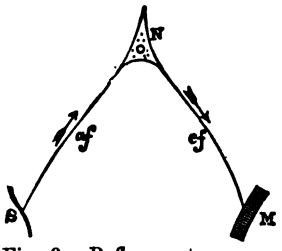


Fig. 9.—Reflex motor arc.—S, skin; *af*, sensory nerve; N, nerve cell; *ef*, motor nerve; M, muscle.

1. *Descending Nerves, Motor Nerves*, or nerves of movement, which leave the cord at different parts of its course to reach the muscles, to which they are distributed, and whose action they govern ; and

2. *Ascending or Sensory Nerves*, which convey sensation from the surface of the body, from the skin, and from the tissues, to the brain.

A Motor Nerve telegraphs from the brain to a muscle the order to carry out a special movement, and the nervous impulse so conveyed stimulates the muscle to contract. The sensory nerves convey to the brain messages from the surface of the body, and it is through them that we feel.

To take an example of an act performed voluntarily on an impulse reaching the brain through a sensory nerve :—Imagine the case of a child drawing away its hand on having its finger suddenly pricked. The sensation of pricking passes from the

skin through a sensory nerve to the brain (see Fig. 9), where it is interpreted as pain, while the brain immediately telegraphs back through the motor nerves of the arm a message to the muscles, which are stimulated by their special nerves to contract and so to withdraw the hand.

3. *Sympathetic Nerves.*—In addition to the two great classes of nerves already described, there is a third class known as "Sympathetic" nerves, which are found mainly in the chest and abdomen, and are distributed to the large organs of these cavities, the stomach, heart, lungs, intestines, &c. They preside over the important functions of digestion, circulation, and respiration.

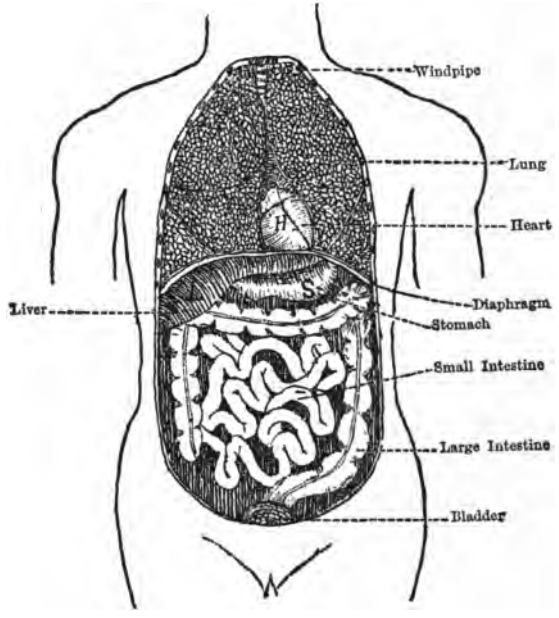


Fig. 10.—Contents of chest and abdomen (from the front).

4. *Nerves of Special Sensation.*—From the brain, through special openings in the skull, pass the nerves of "special sensation" to the interior of the ears, eyes, and nasal cavity. These nerves of special sensation preside over the four special senses—sight, hearing, taste, and smell—and convey messages to the brain from their complicated and delicately arranged nerve-endings in the eyes, ears, mouth, and nose.

II. THE THORACIC OR CHEST CAVITY.

The chest-box, or **thorax,** is formed by the twelve dorsal vertebræ, the ribs, and the **sternum,** or breast bone. The ribs are attached to the dorsal vertebræ behind, and to the breast bone in front, and consist of twelve pairs. The two lower pairs have no attachment in front, and are hence known as "floating ribs" (see Fig. 1). The thorax is separated from the abdomen by a large and important sheet of muscular tissue known as the **midriff** or **diaphragm** (see Figs. 10 and 11); and contains the organs of circulation and respiration, the heart with its large blood-vessels, and the lungs. Through it also the gullet passes to join the stomach. The chest-wall is lined by a serous membrane known as the *pleura*, which is reflected over the surface of the lung. Inflammation of this membrane is known as *pleurisy*. The serous covering of the heart is known as the *pericardium*.

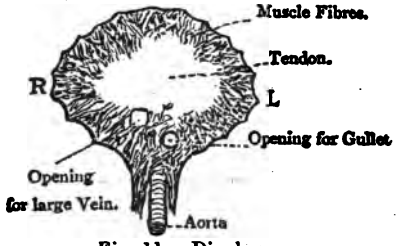


Fig. 11.—Diaphragm.

1. **ORGANS OF CIRCULATION.**—The **blood** is circulated through the body by means of the heart and blood-vessels. Blood is a fluid tissue, and has been well described as an internal medium—a "go between" the outer world and the tissues. It serves two great purposes:—(1) It carries nutrient materials to the tissues in the shape of the food-products absorbed from the intestine after digestion, and is also the medium whereby oxygen, a gaseous food, is taken up from the air entering the lungs, and carried to the tissues to assist in the chemical changes connected with vital processes. (2) Its second function is no less important, and consists in its being the channel whereby useless materials are got rid of by being absorbed into the blood, and carried by it to the kidneys and other organs whose function it is to eliminate the products formed by tissue-waste and change.

As it leaves the body, the blood is to the naked eye a simple red fluid; but the microscope shows it to consist of a clear fluid known as **serum,** in which float solid particles known as **corpuscles.** The corpuscles are of two kinds—red and white

(see Fig. 12). The red corpuscles, the more important, are small discs, each $\frac{1}{3200}$ inch in diameter, and are the medium whereby oxygen is carried along the blood stream to the tissues. There are 350 red corpuscles to each white cell. When exposed to air, blood has the power of *coagulating*, or forming a clot; the blockage of a cut blood-vessel by a clot is nature's method of arresting hæmorrhage.

As the blood leaves the heart in its pure oxygenated condition to circulate through the body, it is bright red; but as it passes through the tissues, it becomes impure and darker in colour from the absorption of effete products and the loss of oxygen. We have thus in the body *two* conditions of the blood—pure and impure. Similarly, we have two sets of blood-vessels, arteries, and veins; and practically two hearts—a left heart for the reception and circulation of the pure or arterial blood; a right heart for the impure or venous blood. The vessels containing pure blood are known as **arteries**; those containing impure blood as **veins**. The only exception to this general rule is in the case of the great arteries and veins entering and leaving the lungs. The former (**pulmonary arteries**) carry impure blood from the right side of the heart to the lungs to be purified, while the latter (**pulmonary veins**) carry back to the left heart the blood purified in the lungs. Between the arteries and the veins is a system of very minute vessels, visible only with the microscope, and known as **capillaries**. The capillaries, which are so small as to allow the passage only of single corpuscles in a row, form a looped network throughout the organs and tissues of the body. The arteries have much thicker coats than the veins, so that when cut across these tubes gape and bleed readily, whereas the veins, having thinner coats, are much more readily collapsible. Through the arteries the blood, propelled rhythmically by the heart, flows in a series of jets or jerks; in the veins it is slowed down into a continuous and steady stream. Thus, when an artery is wounded, the blood

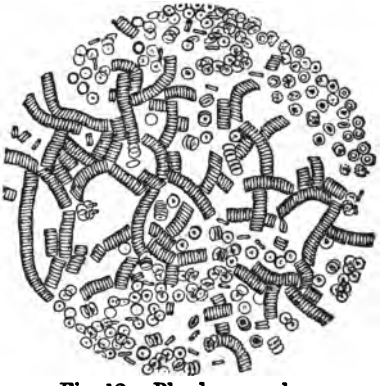


Fig. 12.—Blood corpuscles.

spurts out in jets; while it issues from a cut vein slowly and steadily.

The Heart.—The heart (Fig. 13), which is fitly compared to a force-pump, may be said to consist of two halves—a right heart and a left heart, the former venous, the latter arterial—each half being again divided into a receiving-chamber or **auricle**, and a propelling chamber or **ventricle.** The walls of these chambers

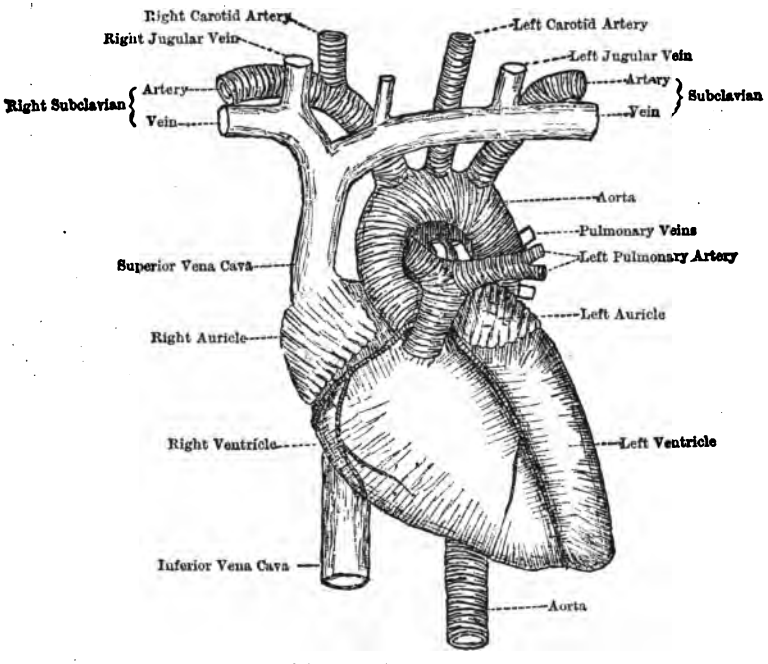


Fig. 13.—The heart.

are formed of muscle, by the contraction of which the blood is propelled—the direction of propulsion being regulated by **valves** (Fig. 14). Heart disease is usually due to improper action of one or other of these valves, which has contracted and become incompetent as a result of inflammation.

The Pulse.—The rate and force of contraction of the heart is estimated by the pulsation of the arteries. The pulse may be taken in any of the larger arteries, the one usually chosen being the **radial artery** on the front and outer side of the

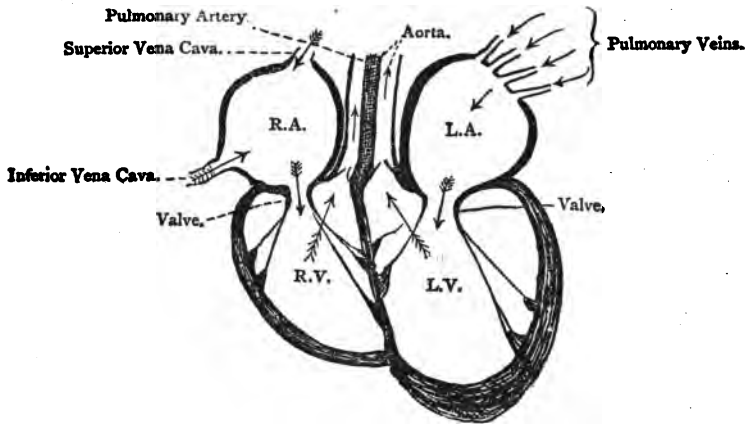


Fig. 14.—The circulation in the heart.

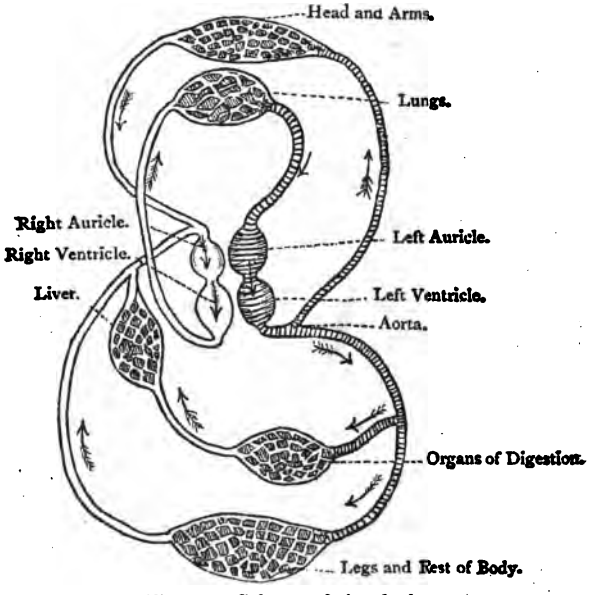


Fig. 15.—Scheme of circulation.

wrist. The pulse may be felt distinctly, and is sometimes taken in the **temporal artery**, half an inch in front of the opening of the ear. The normal rate of the pulse in an adult is sixty to eighty beats per minute; at the extremes of life in young children and old people it is faster than this.

Scheme of Circulation.—The blood leaving the left ventricle by a large blood-vessel (the aorta) in a pure or arterial condition, is distributed from the arteries to the capillaries, and to all the tissues and organs of the body which it nourishes in its passage (Fig. 15). From the capillaries it is collected into the veins, whence it passes to the right side of the heart, entering the right auricle. From the latter it passes into the right ventricle, and thence is forced through the pulmonary artery to the lungs, where it is purified. From the lungs it returns to the heart by the pulmonary veins, entering the left auricle, whence it flows into the left ventricle, and thus the circle is completed (Fig. 16).

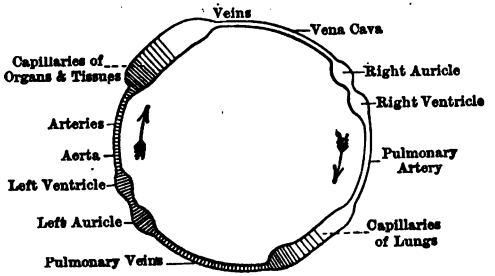


Fig. 16.—Scheme of circulation (arterial circulation shaded).

In a tabular form the order of the circulation is—

Left ventricle.
Aorta.
Arteries and capillaries.
Veins.
Venæ cavæ.
Right auricle.
Right ventricle.
Pulmonary artery.
Capillaries of lungs.
Pulmonary veins.
Left auricle.
Left ventricle.
Aorta.

2. **ORGANS OF RESPIRATION.**—Respiration or breathing consists of two great parts—**Inspiration**, or "breathing in," and **Expiration**, or "breathing out." The air as it is inspired consists of three gases—Oxygen (O), nitrogen (N), and carbonic acid (CO_2). When expired air is examined, it is found to have undergone a considerable change, its carbonic acid being increased

a hundredfold, while its oxygen is considerably diminished, the nitrogen remaining unchanged. Oxygen is, therefore, taken up in the lungs during respiration, while carbonic acid is given off. The object of respiration, then, is to supply oxygen for the oxidation which is a necessary part of the **metabolism** or tissue-change of the body, as well as to remove the carbonic acid formed within the body by the combustion which attends the wear and tear of the tissues. The interchange of gases between the air and blood in the lung and skin capillaries (for the skin also assists in respiration) has been called the "outer" respiration, while the similar interchange that goes on in the tissues, as evidenced by the change of arterial into venous blood, has been called the "inner" respiration.

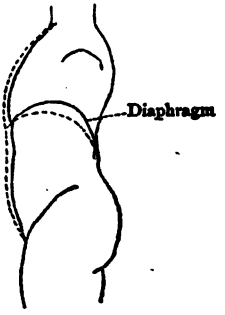


Fig. 17.—Diaphragm and abdominal wall at end of expiration (plain outline) and at end of inspiration (dotted outline).

The respiratory apparatus consists of three parts—

(*a*) **The Chest-Wall.**—The chest-wall acts like a pair of bellows, and moves the air within the lungs by the ascent and descent of the ribs consequent on the contraction of the muscles of inspiration and expiration attached to the ribs. The great muscular organ of inspiration is the **diaphragm,** or midriff, which by its descent on contraction (*vide* Fig. 17) produces a vacuum in the chest into which air is sucked.

(*b*) **The Air-Passages.**—These consist of (1) the nose and back of the throat (chambers in which the air is warmed as it passes along—Fig. 18). (2) The **larynx** (voice box or Adam's apple) contains the vocal cords by the vibration of which the voice sounds are produced. The larynx in the act of swallowing is covered by a valve-like piece of cartilage attached to the back of the tongue, and known as the **epiglottis.** This prevents food from entering the air tubes. Food "going the wrong way" has managed to pass the epiglottic valve. And (3) the **trachea** or windpipe. The trachea divides into two **bronchi** or bronchial tubes, which ramify into smaller branches till they become very small tubes known as **bronchioles** (Fig. 19).

(*c*) **The Lungs.**—The lungs consist of an immense number of small nest-like cavities called air-sacs or **vesicles,** in which the bronchioles terminate (Fig. 20). These little chambers contain air, and are densely covered with capillary blood-vessels, bringing

their blood to the air in the lungs to be purified (Fig. 21). Between the air in the lungs and the blood in the capillaries an interchange of gases goes on, which results in a part of the

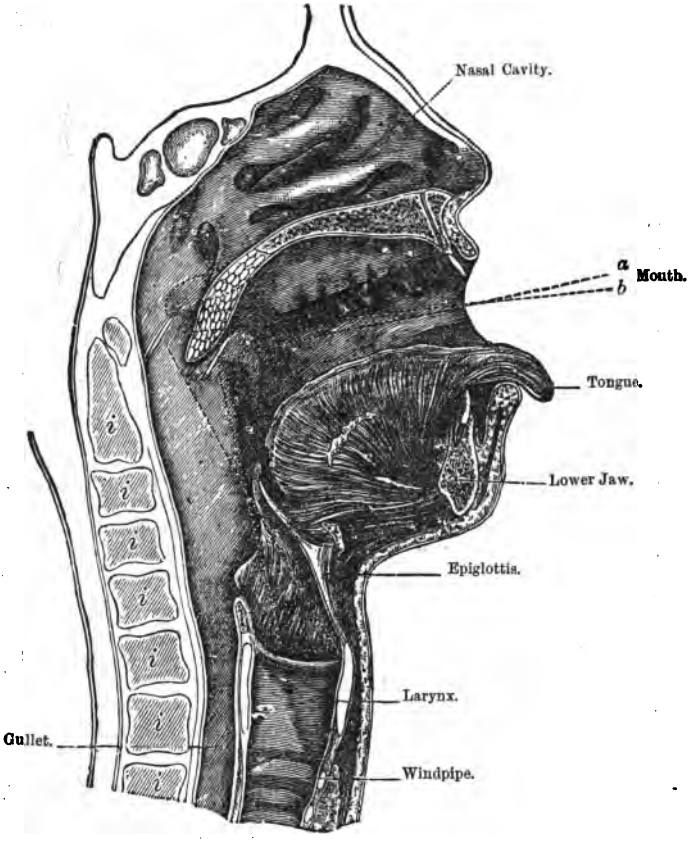


Fig. 18.—The air passages.
i i i i = Vertebræ.

atmospheric oxygen being taken up by the purified blood, while the impure carbonic acid formed by tissue change in the body is in turn given up to the air and is expired. It is mainly this

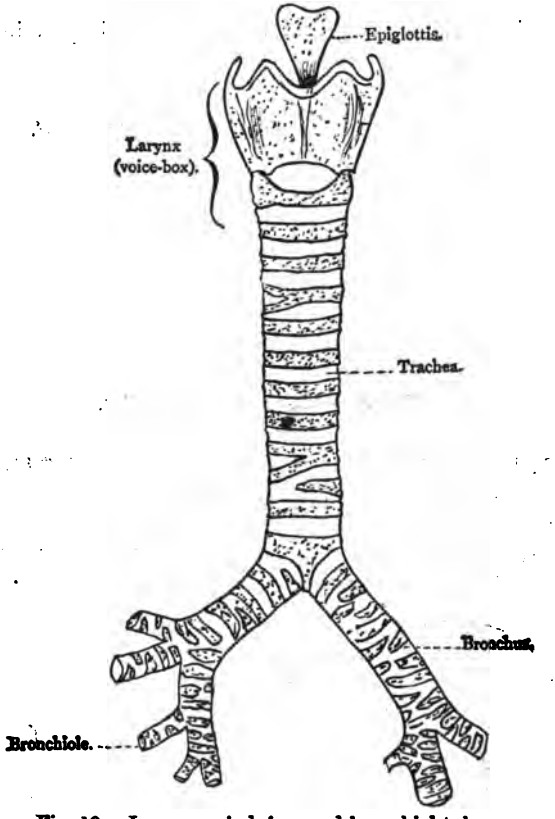


Fig. 19.—Larynx, windpipe, and bronchial tubes.

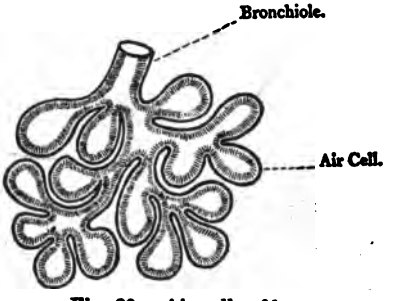


Fig. 20.—Air-cells of lung.

"breathing out" of CO_2 that makes the air impure in an overcrowded room.

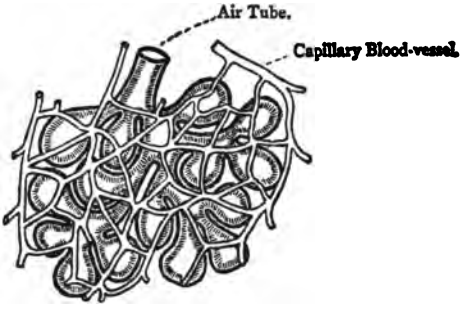


Fig. 21.—Air-cells and capillaries.

III. THE ABDOMINAL OR STOMACH CAVITY.

The abdominal cavity is divided into the abdomen proper and the pelvis. The former is bounded behind by the lumbar vertebræ, above by the diaphragm and ribs, and in front and at the sides by large muscles.

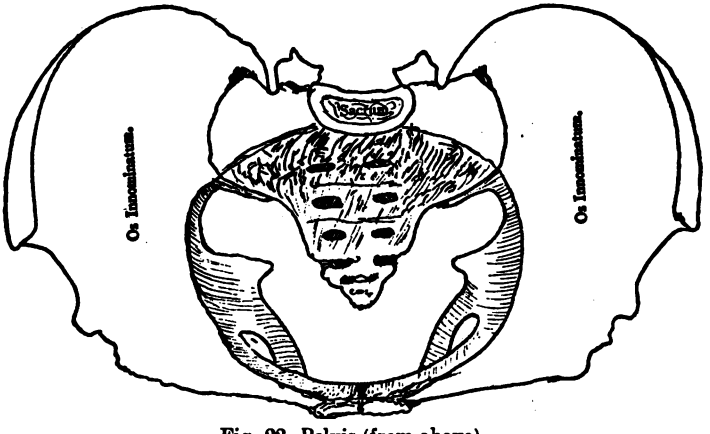


Fig. 22. Pelvis (from above).

The **pelvis** is a basin-shaped cavity bounded behind by the *sacrum*, or rump-bone, and its appendage, the *coccyx*, and at the

front and sides by the haunch bones (Fig. 22). It contains the urinary bladder, the end of the large intestine (*rectum*), and part of the organs of generation.

The **abdomen proper** contains the organs of digestion, absorption, and excretion, which will be best described under these headings. The relative position of the organs of the abdomen is shown in Fig. 10. On the left side close to the ribs and the diaphragm lies the **stomach**, while the similar position on the right side of the body is occupied by the liver. Behind and below the stomach lie the **spleen** and **pancreas** (sweet-bread). On either side of the back part of the abdomen lie the **kidneys**. From the stomach the food passes into the **small**

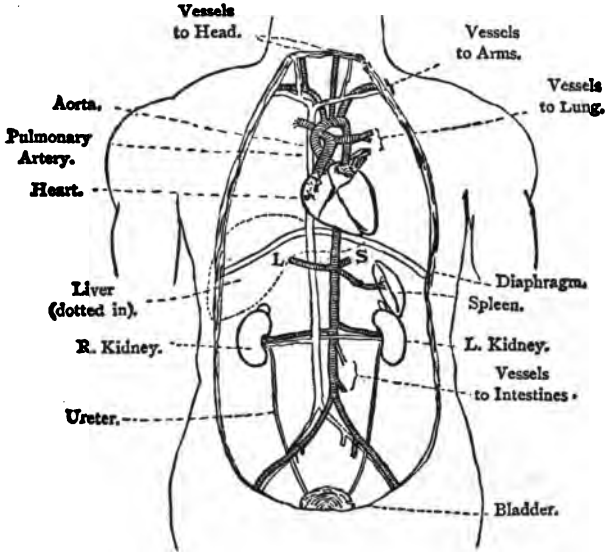


Fig. 23.—Abdominal and chest organs and vessels (lungs and alimentary canal removed). Arteries, with cross markings; veins, unshaded; L. and S., arteries to liver and stomach.

intestine, which is a long coiled-up tube, 20 feet in length, which ends in the right flank in the large intestine. The **large intestine** arches up as shown in Fig. 10 along the right side, and, crossing over, passes down the left side to enter the pelvis The abdomen in addition contains the **aorta** or main arterial trunk, giving off its large branches to the liver, spleen, kidneys,

intestines, and other abdominal organs, and dividing opposite the fourth lumbar vertebra into two large trunks for the supply of blood to the lower extremities (see Fig. 23). Along with the aorta runs a large vein, the **inferior vena cava,** which carries the impure blood back from the lower extremities and the abdominal organs to the heart. Running up the front of the spine, close to the aorta, is the **thoracic duct,** the function of which will be described presently. In the abdomen, high up on the left side, and behind the stomach, lies the spleen, an organ which has an important duty to fulfil in the formation of blood. The inner wall of the abdomen is covered by a serous membrane similar to the thoracic pleura, and known here as the **peritoneum.** The peritoneum is folded round the stomach, intestines, and liver, and covers the other large abdominal organs. Inflammation of the peritoneal covering of the intestine is popularly known as inflammation of the bowels.

We pass next to the consideration of the three great functions of digestion, absorption, and excretion.

DIGESTION.—By "digestion" is meant the process whereby the food taken into the body is chemically changed, so as to become soluble and easily absorbable into the circulation. Foods may be divided into five great classes :—

(1) *Proteids.*—Albumen (white of egg), beef, mutton, and the ordinary flesh foods are the best representatives of this class.
(2) *Carbo-hydrates—e.g.*, starch and sugar.
(3) *Fats.*
(4) *Salts.*
(5) *Water.*

A man doing moderate work requires every day about 24 ounces of water-free-food. Of these 24 ounces, $4\frac{1}{2}$ belong to the proteid or albuminous class, and $14\frac{1}{2}$ to the carbo-hydrate or starch class. These 19 ounces of albuminous and starchy food are insoluble, and have by the process of digestion to be so changed as to become soluble and easily absorbable into the blood. When absorbed, they are passed on to the tissues to nourish them. When the food has been broken down by chewing it comes in contact in the mouth with the saliva, and has its starchy constituents acted on by a ferment present in saliva, which converts the insoluble starch into soluble sugar (see Fig. 24). The food is then swallowed and passes into the stomach. In the stomach it is acted on by a fluid known as the **gastric juice,** which is secreted by glands in the stomach, and by this

fluid the insoluble *proteids* are rendered soluble and become *peptones*. When the food has been sufficiently acted upon in the stomach it passes through the pyloric valve into the small intestine, and the partially digested food is now known as chyme. The chyme is slowly passed along the small intestine by the contraction of the muscular wall of the bowel, and during its

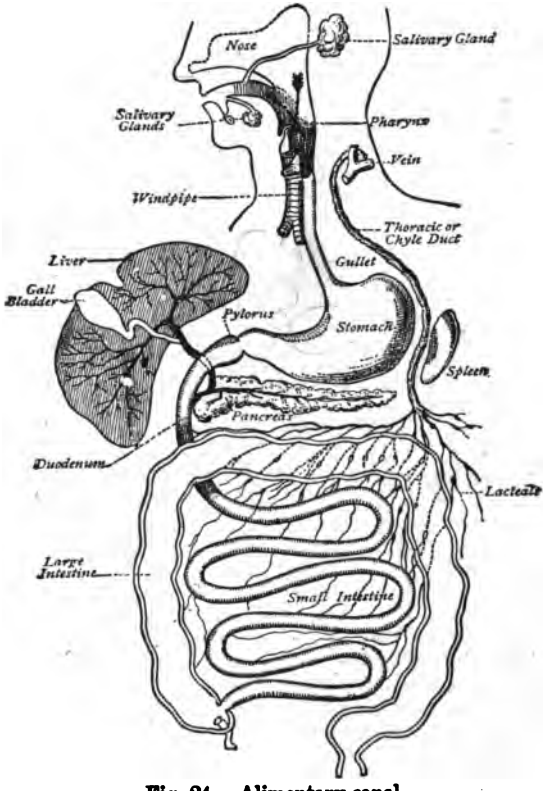


Fig. 24.—Alimentary canal.

passage comes in contact with other digestive fluids poured into the intestine from the pancreas, liver, and intestinal glands. By the fermentative action of the fluids in the intestine, the elements of the food which still remain insoluble are acted on, and become soluble. The food has now become changed into a

liquid, which can be easily absorbed and is ready to be taken up into the blood.

ABSORPTION.—The chyme or soluble food is absorbed from the intestine into vessels known as **lacteals** or **milk tubes** (Fig. 25), so called from the milk-like appearance of the digested

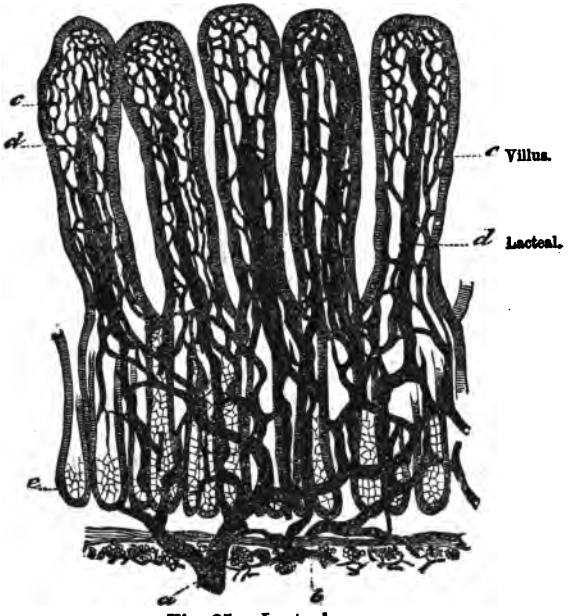


Fig. 25.—Lacteals.

food which they contain. The lacteals lie in the centre of the villi, which are microscopic finger-shaped prominences, with which the wall of the intestine is studded. The changed food, when it passes from the intestines into these special vessels, is known as **chyle**. The lacteal vessels discharge their contents into a large vessel known as the *thoracic duct*, which passes up the front of the spine close to the aorta, and pours its contents into a large vein at the lower part of the neck. It is through this complicated process and long course that the food has to pass before it reaches the blood, and has its nourishing properties distributed to the tissues of the body. In connection with absorption, it is necessary to mention that the thoracic duct has also poured into

it the contents of the lymphatic vessels. These **lymphatic vessels** are distributed through the tissues, and are said to act as sewers by taking up the excess of the fluid part of the blood shed out to nourish the tissues. These lymphatic vessels receiving, as it were, the overflow of blood, pass the lymph which they contain through the lymphatic glands before it reaches the thoracic duct (see Fig. 26). The absorptive power of the

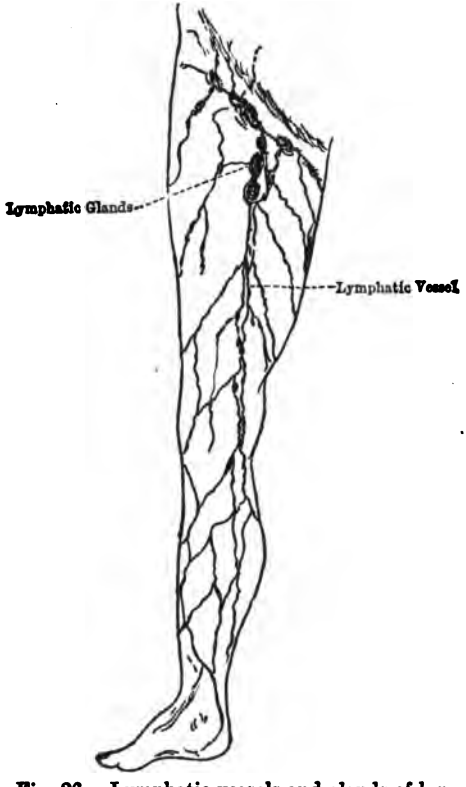


Fig. 26.—Lymphatic vessels and glands of leg.

lymphatics is well seen in the case of a poisoned wound of the hand, or a dirty leg ulcer, where the poisonous matter is taken up by the lymphatics in such quantity as to cause the nearest lymphatic glands to enlarge and inflame.

EXCRETION.—By excretion is meant the process whereby the waste products formed by tissue-change in the body are got rid of. The main organs of excretion are found in the urinary system. Excretion also takes place partly in the form of perspiration from the skin, and in the air expired by the lungs. The unaltered and useless elements of the food are excreted by the intestine. The **Urinary System** consists of the two **kidneys**, their **ureters** or ducts, and the **bladder** (Fig. 27).

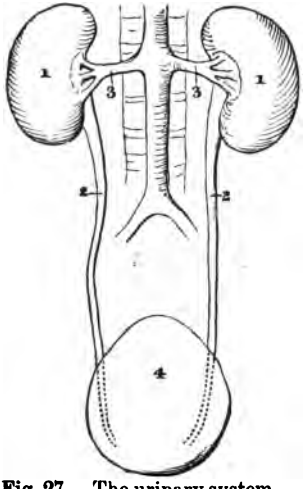


Fig. 27.—The urinary system.—1, kidney; 2, ureter; 3, renal arteries; 4, bladder.

The two kidneys lie, one on each side of the spine, in the back part of the abdomen in the position shown in Fig. 23. Blood is supplied to them in large quantities by special arteries given off by the aorta. The kidneys have the power of acting on the blood, and of removing from it the waste deleterious products which are formed by the wear and tear of the tissues, and which, if left in the circulation, would produce poisonous effects upon the body generally. The fluid containing these waste products separated by the kidneys is known as **urine**. It is carried from the kidneys along the ureters to the bladder. Fifty ounces of fluid are excreted by the action of the kidneys in twenty-four hours. In fever, and in certain diseases of the kidneys, the quantity of urine passed is much diminished, while in other diseases—*e.g.*, diabetes—it is very much increased.

(B) *THE EXTREMITIES OR LIMBS.*

THE BONES OF THE LIMBS.—The upper and lower limbs are built on the same plan, and are best considered together. It should be remembered that the back of the forearm corresponds to the front of the leg, and for exact comparison the thigh will be found to correspond to the arm, the leg to the forearm, and the hand to the foot. The two extremities, so studied, present resemblances which are very striking (Figs. 28 and 29). They consist each of a special bone or bones for the attachment of the

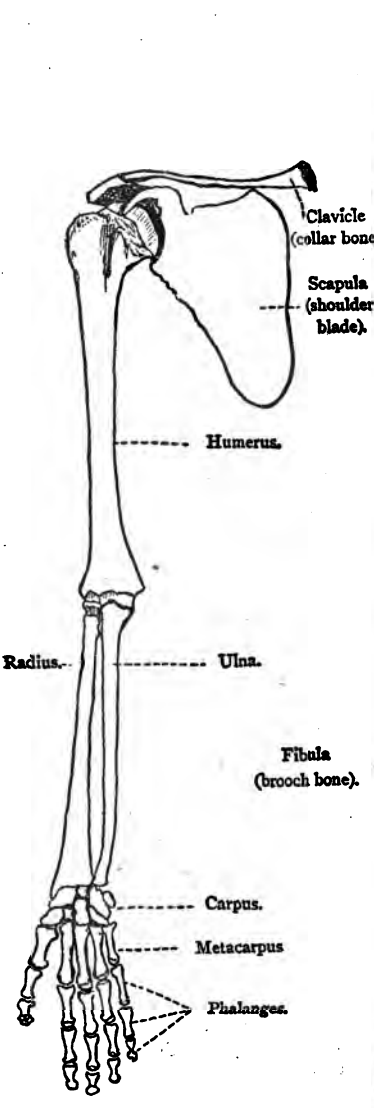


Fig. 28.—Bones of the arm.

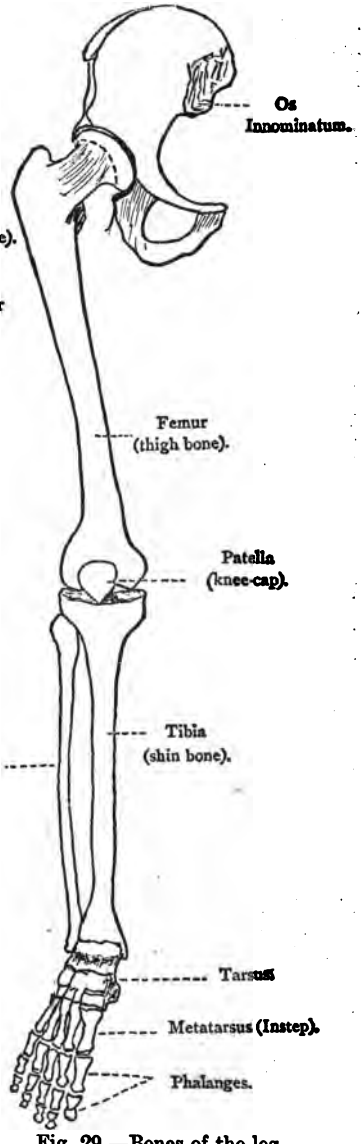


Fig. 29.—Bones of the leg.

extremity to the trunk. In the leg this consists of the pelvic girdle, or **haunch bone (Os innominatum), which in the arm** is represented by the two bones of the shoulder girdle—the **shoulder blade (scapula)** and the **collar bone (clavicle).** From this point of attachment a long bone runs down the upper part of each extremity—in the lower extremity the thigh bone (or **femur**), in the upper extremity the arm bone (or **humerus**). Attached to each of these are two bones, an inner and an outer. In the leg the inner and larger bone is known as the **shin bone** or **tibia,** the smaller and outer bone as the **brooch bone** or **fibula,** while in the forearm the two bones are known as the **radius** (the bone on the outer or thumb side), and the **ulna** (or inner bone of the forearm, which is distinctly felt on the back of the forearm). In front of the knee joint is a bone known as the **knee-cap** or **patella,** which may be represented by the well-marked and prominent process of the ulna to be felt on the back of the elbow joint, and known as the **olecranon process.**

It is worthy of notice that in the arm, for the purpose of greater movement, the bones are so arranged as to allow pronation, a movement not possible in the leg—*i.e.*, the two bones of the forearm can be made to cross as in the movement of placing the hand prone or palm downwards on a table.

The ankle and wrist joints are formed by a number of small bones joined together so as to give a considerable range of movement; those in the leg being known as the **tarsus** (seven bones), those in the arm as the **carpus** (eight bones). Passing forward from these are the five bones of the instep (**metatarsus**), and of the palm (**metacarpus**), while attached to each of the metatarsal and metacarpal bones are small bones known as **phalanges,** which form the toes and fingers respectively. These phalanges are three in number in each finger and toe, save in the case of the thumb and big toe, which have two only.

Arm.	Leg.
Shoulder Girdle { Scapula—Shoulder blade. Clavicle—Collar bone.	Haunch bone (os innominatum).
Humerus—Arm bone.	Femur—Thigh bone.
Radius, Ulna { Outer, Inner } Forearm bones.	Fibula, Tibia { Outer, Inner } Leg bones.
Olecranon process of ulna.	Patella—Knee-cap.
Carpus—Wrist.	Tarsus—Ankle.
Metacarpus—Palm.	Metatarsus—Instep.
Phalanges—Fingers.	Phalanges—Toes.

JOINTS AND LIGAMENTS OF THE EXTREMITIES. —Where the bones unite to form a joint, as in the knee, their surfaces are covered by a special form of cartilage or gristle, so as to render the opposing surfaces smooth and easy of movement.

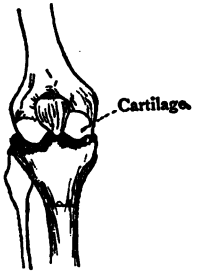


Fig. 30.—Bones and cartilages of knee joint.

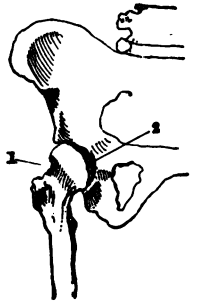


Fig. 31.—Bones and cartilages of hip joint (ball and socket joint).

This is further secured by the walls of the joint being lined by a special membrane (synovial membrane), which pours out an oily fluid known as *synovia*, and so keeps the surfaces lubricated

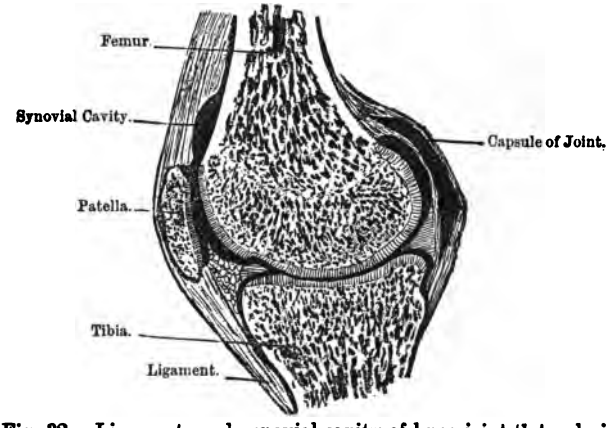


Fig. 32.—Ligaments and synovial cavity of knee joint (lateral view).

and prevents friction. The well-known changes that take place in joints, the seat of chronic rheumatism, are due to alterations in the cartilaginous surfaces, and in the synovia. The joints

of the extremities may be divided into two kinds—(1) the "**hinge**" joint, as seen in the knee (Fig. 30); (2) the "**ball and socket**" joint, as seen in the hip (Fig. 31).

The bones at a joint are held together by strong bands or straps of fibrous tissue known as **ligaments** (Fig. 33). These permit only a certain range of movement, and prevent the joint from being dislocated or put out of place. In the larger joints the ligaments are very strong, and form "**capsules**" which entirely enclose the ends of the bones forming the joint. "Imperfect" joints are joints in which only a limited range of movement is allowed, and are best exemplified by the joints between the spinal vertebræ.

MUSCLES.—Attached to the bones are masses of contractile tissue, by which the different parts of the skeleton are moved. These masses of tissue are known as muscles, and form the red fleshy parts, or "beef" of the body. Muscles have the power, on stimulation by a motor nerve, of contracting or growing shorter, and thereby of altering the position of the parts to which they are attached. The muscles of the skeleton are under the control of the will, the stimulation causing con traction being conveyed to them directly from the brain. They are therefore known as **voluntary** muscles, in contra-distinction to the **involuntary** muscles, which are not under the control of the will, and which go on acting independently under a special nervous mechanism of their own. Involuntary muscles are known as **white** or **organic** muscles, and are found principally in such organs of the body as the stomach, bladder, and intestine. Heart muscle, though it is red like voluntary muscle, is involuntary; one cannot regulate the rate of contraction of the heart at will. The skeletal or red muscles, so called from their colour, may be attached to bones either directly or through the intervention of a band of fibrous tissue, which is known as a **tendon**

Fig. 33.—Ligaments of knee joint.

or **sinew.** Typical muscles—*e.g.*, the biceps of the arm and the ham-string muscles of the leg—consist of three parts :—

(*a*) *A tendon of origin.*—In the biceps muscle, the point from which the muscle springs is a process of the scapula or shoulder blade (see Fig. 34).

(*b*) *A fleshy belly of contractile muscular substance,* which on stimulation becomes shorter and so causes movement of the bone to which the tendon of insertion is fixed.

(*c*) *A tendon of insertion.*—In the case of the biceps, this is attached to the outer of the two forearm bones. The movement

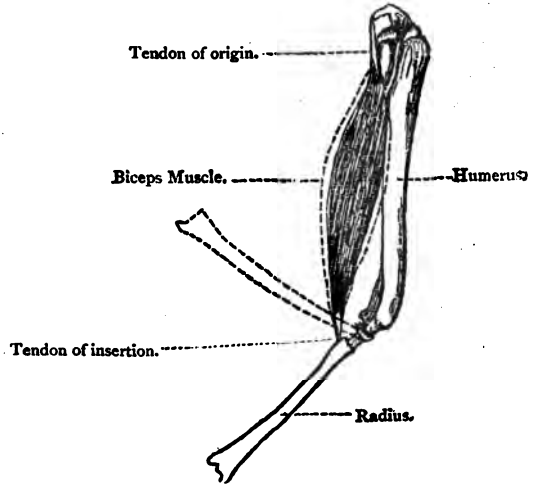


Fig. 34.—Biceps muscle, showing movements of the radius on contraction.

of the radius caused by contraction of the biceps muscle is shown in Fig. 34.

CHAPTER II.

THE TRIANGULAR BANDAGE AND ITS USES.

USES — FIGURED BANDAGES — HOME-MADE BANDAGES — KNOTS — LARGE ARM SLING — SMALL ARM SLING — EYE BANDAGE — LOWER JAW BANDAGE — SCALP BANDAGE — CHEST BANDAGE — SHOULDER BANDAGE — ELBOW BANDAGE — PALM BANDAGE — HAND BANDAGE — HIP BANDAGE — KNEE BANDAGE — SOLE BANDAGE — FOOT BANDAGE — THE TRIANGULAR BANDAGE AS A TOURNIQUET.

To the student of "First aid" methods, a thorough knowledge of the uses and method of application of the triangular bandage is absolutely essential. The triangular bandage is *the* emergency bandage, and its application forms an important part of the practical work of an ambulance class.

USES OF THE TRIANGULAR BANDAGE.—The triangular bandage may be employed for the following purposes in the rendering of "first aid" to the injured:—

(1) To keep dressings on wounds.

(2) To support weak or injured parts—*e.g.*, in the case of a sprained or dislocated joint.

(3) To keep splints or external supports firmly fixed to the limb in the case of a broken bone, thus saving the patient unnecessary pain, and securing the healing of the bone in proper position.

(4) To keep muscles at rest in cases of fracture, and particularly where muscles tend by contraction to pull apart the ends of a broken bone.

(5) To stop bleeding. A bandage may fulfil this purpose in three ways:—

(*a*) Where the bleeding is slight (as in small cuts) by being applied directly to a wound over a dressing or pad of lint.

(*b*) Where the bleeding is severe, by being applied tightly round a limb at some distance *above* the bleeding point—*i.e.*, nearer the heart, so as to compress the main artery of the limb against the bone, and so check all flow of blood to the part. It is then said to serve the purpose of a "**tourniquet**" or constricting band.

(*c*) By being applied immediately beneath a bleeding point—(*i.e.*, further from the heart) in cases of burst "varicose" or dilated veins, or of severed healthy veins.

Various forms of the triangular bandage are now in use in different ambulance centres. The original triangular bandage, one used for many years in the German army, is the figured

Fig. 35.—Figured bandage.

bandage invented by Professor Esmarch of Keil. It has a base of 50 to 54 inches, and sides of 33 to 36 inches. On its surface are printed for reference figures illustrating the methods of application of the bandage to various forms of injury. This bandage may be procured from Messrs. Maw, Son, & Thomson, Aldersgate Street, London. Bandages similar to Professor Esmarch's, but with a larger number of figures, are supplied to classes taught under the St. John Ambulance Association, London, and may be had from the St. John Ambulance Association Stores. Dr. Beatson has prepared a similar bandage for the St. Andrew's Ambulance Association, Glasgow. Esmarch's and the figured bandage are of special service in military surgery, to members of the police force, and in public works, where reference may have to be made at any moment by those unacquainted with ambulance methods to the proper first aid treatment of an injury. Fig. 35 shows a figured bandage made by Messrs. Evans & Wormull, London. In ambulance class practice, and in the treatment of ordinary domestic accidents, the "home-made" bandage is equally useful and much cheaper. It has also the advantage that it may be made, if necessary, from the clothing of the patient. Such a bandage is prepared by dividing into two triangles, from corner to corner, along one of its diagonals,

a piece of calico or flannel 3 feet square (see Fig. 36). This is the adult size, and will be found to be too large for easy applica-

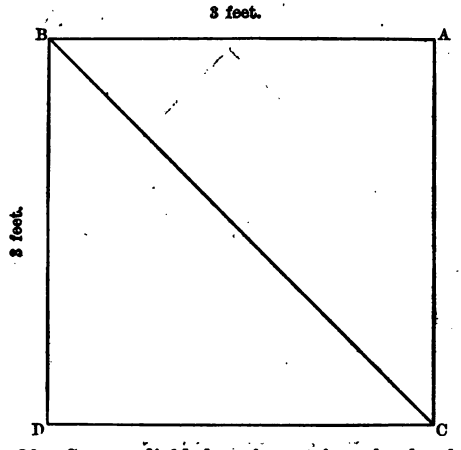


Fig. 36.—Square divided to form triangular bandages.

tion to the juvenile model usually employed in ambulance classes. For such a purpose it is preferable to prepare two bandages by cutting a 2-feet square of calico in the way directed above. Such a bandage will be found to be more serviceable and capable of neater application.

KNOTS.—The triangular bandage should always be secured by a "reef" knot, which is much firmer than the so-called

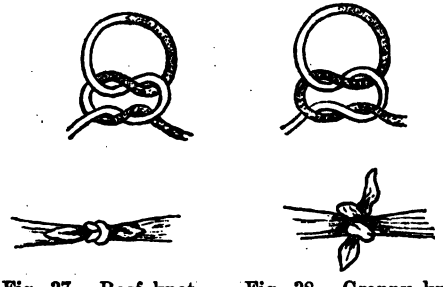


Fig. 37.—Reef knot. Fig. 38.—Granny knot.

"granny" knot. It has also the advantage of being more easily unfastened. The reef knot is a symmetrical one, as may be seen

from the diagram (Fig. 37), and is tied by running down a single hitch, the end then in front being kept in front while the second hitch is taken. The reef knot, if properly tied, will have the two free ends lying in the same line as the bandage (Fig. 37), while the "granny" knot may easily be recognised by the free ends standing after tying at right angles to the main line of the bandage (see Fig. 38). The "surgeon's knot" is firmer even than the reef; and is tied exactly like it, save that a double turn is taken instead of a single before the second hitch is run down.

APPLICATION OF THE TRIANGULAR BANDAGE.—In describing the application of the triangular bandage to different parts of the body, it is necessary for the sake of

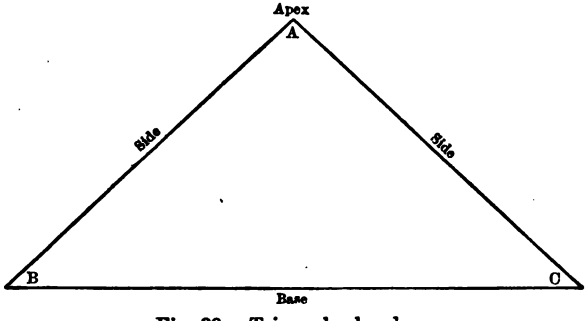


Fig. 39.—Triangular bandage.

clearness to designate its different parts by special names, and the most convenient are the geometrical terms, viz., the apex or point of the triangle A, the sides A B and A C, and the base B C (see Fig. 39).

The bandage has often to be applied in the form of a scarf or cravat, and may then be used in the form of either "broad cloth" or "narrow cloth." The triangular bandage is folded into "broad cloth" by bringing the apex A to the middle of the base B C, so that the bandage is folded first along the line 1 in Fig. 40, and then again upon itself along the line 2. The "narrow cloth" is prepared by doubling the "broad cloth" bandage upon itself—*i.e.*, by folding it along the line 3 in Fig. 40. The "narrow cloth" bandage is, therefore, half the width of the "broad cloth." The ends of the bandage should not after tying be left hanging loose, but should be neatly tucked away under the nearest fold.

The different methods of applying the triangular bandage are best dealt with in the following order :—

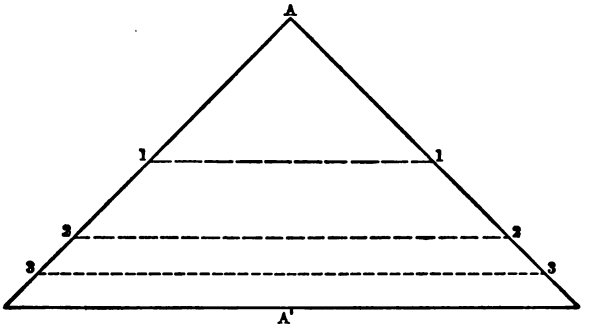


Fig. 40.—Method of folding "broad" and "narrow cloth" bandages.

"Narrow cloth." { 1. Bring A to A¹—*i.e.*, fold along line 1, 1. } "Broad cloth."
{ 2. Fold along line 2, 2.
{ 3. Fold along line 3, 3.

1. The Large Arm Sling.—The "large arm sling" or "broad sling," which is used in cases of fractured collar bone or forearm, is applied by placing the hand with the little finger downwards in the middle of the base, while the apex lies between the injured part and the chest. The end B is then taken over the shoulder on the injured side, while the end C crosses over the opposite shoulder; B and C are then tied, not behind the neck,

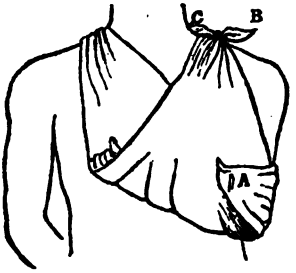


Fig. 41.—Large arm sling.

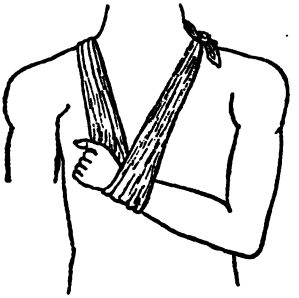


Fig. 42.—Small arm sling.

which might be uncomfortable for the patient while lying, but over the apex of the shoulder. The ends should be tightened until it is seen that sufficient strain has been made on the bandage to take all weight off the muscles of the shoulder and

arm. The bandage should be so arranged as to keep the hand on a higher level than the elbow. The apex is then brought up over the front of the lower part of the arm, is pulled tight, and is pinned over the outer layer of the bandage to prevent the elbow from slipping out (Fig. 41). A safety pin is the best to use for this purpose, but where this cannot be got two ordinary pins inserted at right angles to each other will be found to be equally secure.

2. **The Small Arm Sling.**—The "small arm sling" or "narrow sling," which is used in cases of fracture of the upper arm, is applied in the form either of "broad cloth" or "narrow cloth," the former if the hand only is to be included, the latter if the arm is to be supported by the wrist. The wrist of the injured arm is placed in the middle of the bandage, the end C being taken over the shoulder of the injured side, the end B over the other. The bandage is knotted off on one side of the neck, the ends being tucked away neatly (Fig. 42).

3. **The Eye Bandage.**—The triangular bandage in the form of narrow cloth is applied obliquely over the eye from above downwards, and if short is knotted off behind the head (Fig. 43), or if long is carried round the head again in the same line and knotted off in front over the eye.

Fig. 43.—Eye bandage.

Fig. 44.—Bandage for jaw.

4. **The Lower Jaw Bandage.**—This is used in case of fracture to keep the lower jaw firmly fixed against the upper. The chin is placed in the middle of a "narrow fold" bandage, the ends of which are carried up in a sloping direction over the top of the head, and tied well back to prevent the bandage from slipping forward (Fig. 44).

Another method of applying this bandage, which is useful also for checking bleeding from the artery of the temple, consists in

applying a long "narrow fold" bandage as follows:—The chin resting in the middle of the bandage, the two ends of the bandage are carried up over the head in front of the ears, and are twisted on each other on one side, a little above the opening of the ear, if necessary over a pad placed on the temporal artery,

Fig. 45.

Fig. 46.

Bandage for jaw or temporal artery.

the ends being then carried round the forehead and occiput, and knotted off over the temple. This is known as the "knotted bandage for the jaw or temporal artery" (Figs. 45 and 46).

5. **The Capeline or Scalp Bandage.**—This bandage, known also as the "shawl" bandage, is used to keep dressings or poultices on the scalp. The student standing behind the model places the bandage with the middle of the base at the root of the nose and

Fig. 47.

Fig. 48.

Capeline bandage.

close down on the eyebrows, the apex being left hanging loosely over the back of the neck. The ends of the base are then gathered tightly in the hand, and are carried along just above

the ears, care being taken that the base does not meanwhile slip up on the forehead. The ends are crossed over the apex behind the head, low down in a line continuous with the opening of the ear and below the prominence of the occipital bone, on which one has to rely for the prevention of the slipping upwards of the bandage. The crossed ends are brought forwards and upwards above the ears, and are firmly tied over the middle of the forehead (see Fig. 48), the redundant ends being neatly tucked away at the sides. The apex, kept in position by the crossed ends, is then turned up over the back of the head, and is there pinned (Fig. 47).

6. **The Chest Bandage.**—This is used to fix a dressing or to keep a poultice or fomentation in position. Standing behind the patient, place the apex A from before backwards over the shoulder of the side to be covered. Take the two ends of the base round the lower part of the chest and tie them close to the angle of the shoulder blade on the same side as the apex crosses. This leaves a long end, B, which is then tied to the apex A (see Fig. 50).

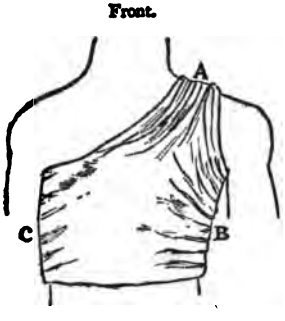


Fig. 49.

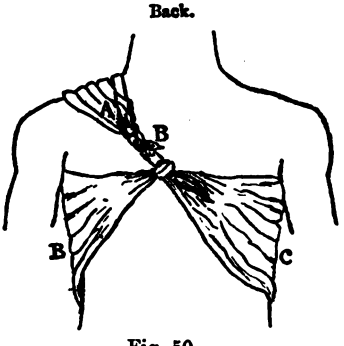


Fig. 50.

Chest bandage.

7. **The Back Bandage.**—This is applied in the same way as the last; the only points of difference are that the student stands in front of the patient, that the apex crosses the shoulder from behind forwards, and that the knots are in front.

8. **The Shoulder Bandage.**—The shoulder bandage is used to keep dressings or compresses on the shoulder, and requires for its proper application two triangular bandages, one of these serving as a fixation bandage. To secure neatness a hem of 3 to 6 inches of the base of the first bandage is turned in.

The apex is carried upwards over the shoulder to lie against the neck. The middle of the new base, formed by turning in a hem as directed, now lies over the middle of the outside of the arm 4 or 5 inches below the shoulder joint. The ends are then carried round the arm in that line once or twice and tied. The apex is prevented from slipping downwards in either of two ways, first by applying a narrow fold bandage with its middle over the apex of the bandage first applied, its ends being passed over the chest and back, and tied under the opposite arm-pit. The apex is then doubled down over the fixation band and pinned (see Fig. 51). The second method consists in supporting the injured arm in a small arm sling, the apex of the shoulder bandage being fixed by the side of the sling crossing the injured shoulder and being turned down over it and pinned. It has also been proposed to cover the shoulder with one bandage by placing the apex over the shoulder as described above, the ends B and C being carried round the arm once and then being brought up over the top of the shoulder where they are tied over the apex, which is then turned down over them and pinned. This, however, is not a secure bandage as, owing to the slope of the shoulder, it is readily displaced by any movement of the patient.

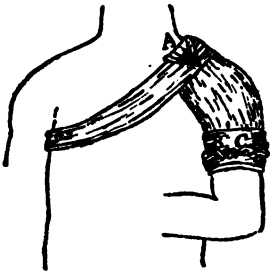


Fig. 51.—Shoulder bandage.

9. **The Elbow Bandage.**—A hem of 6 to 8 inches of the base is taken up to diminish the size of the bandage and so secure greater neatness in application. The elbow being bent, the apex is placed above it so as to lie over the middle of the back of the arm. The ends of the base being carried round the upper part of the forearm are crossed in front and pass upwards in figure of eight fashion over the lower part of the arm, round which they are tied over the apex, which is then turned down and pinned (see Figs. 52 and 53).

10. **The Palm Bandage.**—This may be used for keeping small dressings on the palm or back of the hand. A narrow fold bandage is placed with its middle over the palm. The two ends are passed round the sides of the hand, are crossed on its back, and are then carried round the wrist several times and tied.

11. **The Hand Bandage.**—To cover the whole hand the bandage is placed unfolded on a table with the base towards

the patient, the operator standing by the patient's side. If the hand to be covered is a small one, a hem of 3 or 4 inches of the base of the bandage may be turned in. The hand is then placed on the bandage, with the wrist on the middle of the base. The apex is carried up over the back of the hand to lie on the lower part of the forearm. The two ends are then carried neatly over the hand and round the wrist, which they encircle several times, and are then tied. The apex so fixed is then turned down over the tied ends and pinned (see Figs. 54 and 55).

12. **The Hip Bandage.** — Two bandages are required. One of these in the form of "narrow cloth" is carried round the lower part of the abdomen as a belt or girdle, the ends being tied in front. The second bandage has its apex carried up over the outside of the hip under the "girdle," over which it is pinned. The base, with a 2 to 4 inch hem turned in, has its ends carried round the upper part of the thigh and knotted on the outside (see Fig. 56).

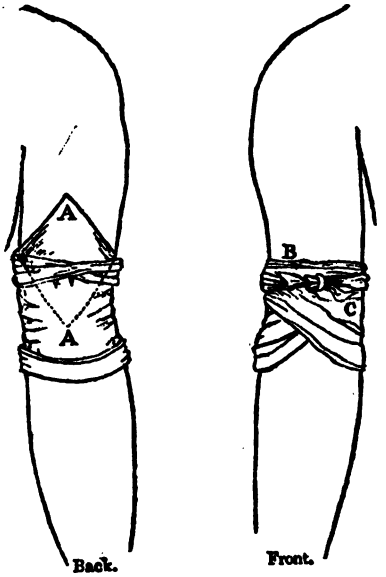
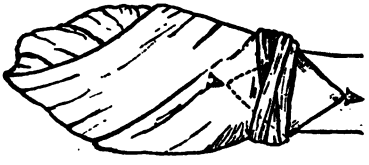


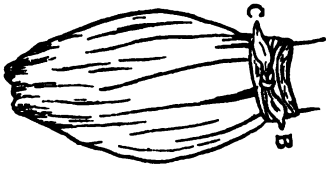
Fig. 52. Fig. 53.

Elbow bandage.



Front.

Fig. 54.



Back.

Fig. 55.

Bandage for hand.

13. **The Knee Bandage.**—This is similar in principle to the elbow bandage (compare elbow bandage, Figs. 52 and 53). The

bandage with a 4 to 6 inch hem rolled in has its apex placed over the front of the thigh about 6 inches above the knee-cap. The ends of the base are crossed on the calf of the leg, and are then carried in a figure-of-eight manner upwards over the lower

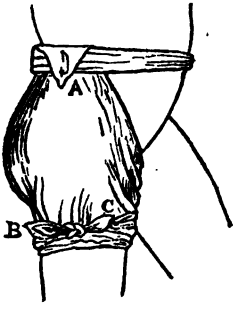


Fig. 56.—Hip bandage.

Fig. 57.—Sole bandage.

part of the thigh, which they encircle. The ends are tied over the apex, which is then turned down over them and pinned

14. **The Sole Bandage.**—This is used to keep dressings on the sole of the foot. A narrow cloth bandage is applied with its middle under the instep. Its two ends are crossed over the front of the ankle, carried round the joint and tied (Fig. 57).

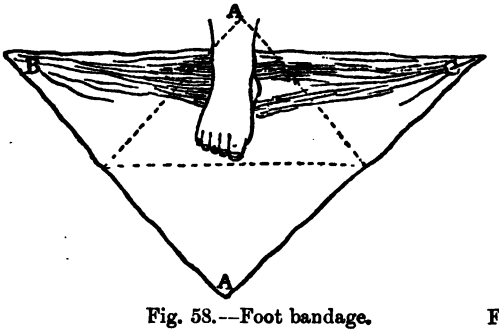


Fig. 58.—Foot bandage.

Fig. 59.—Foot bandage completed.

15. **The Foot Bandage.**—The foot is placed on the bandage with the heel a little in front of the middle of the base (see Fig. 58). The apex is carried up over the front of the ankle. The two ends of the base are then crossed over the front of the

instep, are carried round the ankle, and are then crossed under the sole to meet over the instep where they are tied, or they may be carried several times round the ankle and there tied, as shown in Fig. 59. The apex fixed in either of these ways is turned down and pinned.

16. **To keep dressings on wounds,** a narrow fold bandage is applied in the manner most convenient. In ordinary wounds of the arm or leg, the bandage is wound several times round the limb and tied.

17. **To keep splints in position,** two or more narrow fold bandages are applied firmly embracing limb and splints. If only two bandages be applied to the fractured arm, one should be placed on either side of the site of fracture (see Fig. 60). A very handy and secure method of fixing splints by the triangular bandage is to double the narrow fold bandage on itself so that the end B meets the end C. Next carry the

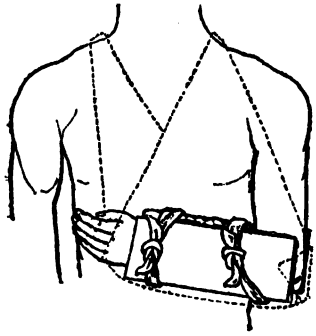


Fig. 60.—Fractured forearm in splints.

Fig. 61.—Esmarch's bandage and tourniquet.

double bandage below the fractured limb and over the splints. The end B is then carried through the loop formed by the middle of the doubled bandage, and is tied securely to the free end C. This method may also be employed to secure a dressing firmly, or to arrest hæmorrhage by a compressing pad placed over the bleeding point. The fixation of splints by the "looped triangular bandage" is frequently employed in military ambulance work.

18. **The Triangular Bandage as a Tourniquet.**—A tourniquet is an instrument employed to prevent hæmorrhage by compressing the main artery of a limb against the bone. Esmarch's tourniquet consists of a thick indiarubber cord, which is applied

tightly round the limb, either next the skin or over a towel or flannel bandage (Fig. 61). An extemporised tourniquet may readily be made from a triangular bandage in the following way:—A narrow cloth bandage, which may be knotted in the centre if necessary, or have a firm pad enclosed in its folds, is placed with the knot or pad over the main artery of the limb, the two ends being carried round and tied with a "reef" knot on the outside of the extremity, which they embrace loosely. As an alternative, the knotted ends of the bandage may be made to take the part of a compressing pad by being placed over the blood-vessel (see A, Fig. 62). Into the loop made by the tied ends a rod is inserted. A walking stick, umbrella, ruler, or sword scabbard will serve the purpose admirably. The rod is then twisted round so as to shorten the bandage, which, after a few turns, is sufficiently tight, to compress the artery against the bone, and so stop all circulation in the part (see B, Fig. 62). Unwinding of the tourniquet may be prevented by fixing the rod firmly to the limb by a second narrow cloth bandage (see C, Fig. 62).

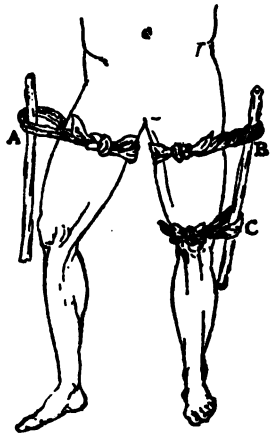


Fig. 62.—Triangular bandage as tourniquet. A, before twisting; B, after twisting; C, additional bandage for fixation.

CHAPTER III.

THE ROLLER BANDAGE AND ITS USES.*

MATERIALS—LENGTH AND BREADTH—SIMPLE SPIRAL—REVERSED SPIRAL—FIGURE-OF-EIGHT BANDAGE—FINGER BANDAGE—CAPELINE BANDAGE—SPICA OF SHOULDER—SPICA OF GROIN—SPICA OF BREAST—SPICA OF THUMB—FOUR-TAILED BANDAGE FOR BROKEN LOWER JAW.

ROLLER bandages are used principally in Hospital and Surgical practice, and though a knowledge of the methods of their application is not absolutely necessary to the ambulance student, it is advisable that he should have an idea how to apply this bandage to parts where it is of special service, and is to be preferred to the triangular bandage. Roller bandages are strips of calico, flannel, or other suitable material of various widths tightly rolled up to facilitate application. The table given below indicates the lengths and widths of the bandages generally in use for application to the fingers, arm, leg, and trunk.

LENGTH AND BREADTH OF BANDAGE.

	Length.	Breadth.
Fingers, . .	1½ yards	¾ inch
Arm, . . .	6 ,,	2-2½ inches
Leg, . . .	8 ,,	3 ,,
Body, . . .	10 ,,	6 ,,

In bandaging with the roller bandage the operator generally stands facing the patient holding the roller in his right hand. In applying the roller bandage to a limb, half a foot of the bandage is unrolled, and the free end is then placed on the inner side of the front of the arm or leg. The bandage is then firmly applied round the extremity in either of the following methods:—

1. Simple spiral.
2. Reversed bandage.
3. The figure-of-eight bandage.

* This chapter need not be read for examinations in Ambulance.

1. **The Simple Spiral.**—The roller bandage may be applied over a part that is not increasing rapidly in diameter—*e.g.*, the upper arm—in the form of the "simple spiral," where the bandage is simply rolled round the arm, each layer leaving the former uncovered by about half its breadth (see Fig. 63). Where, however, the limb is increasing rapidly in diameter—*e.g.*, in the calf of the leg—and in crossing a joint, the "simple spiral" bandage gapes and puckers, and will not lie neatly. It is then desirable that the bandage should be applied either in the form of the "reversed" or "figure-of-eight" bandage.

2. **The Reversed Bandage.**—This bandage, which is firmer than either the "simple spiral" or the "figure-of-eight," and is therefore to be preferred in the application of splints to a fractured limb, is applied as follows:—The bandage is fixed at the lower part of the extremity in the method detailed in the description of the simple spiral. Two or three turns of the simple spiral are taken up the extremity till it is seen that the bandage will no longer lie neatly. The operator then fixes the upper part of the next layer with the thumb of his left hand on the front of the leg, and produces a "reverse" by doubling the bandage on itself in the method shown in Fig. 64. The roller is then carried round behind the limb and is pulled tight. The next layer leaves the last uncovered by about half its breadth, and fixed by the thumb as before is reversed in the same line as the last. The reverses should all lie on the outside of the limb. This bandage, however, is more difficult to apply neatly than the others.

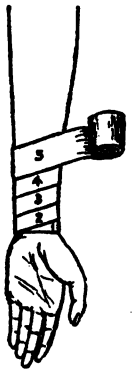


Fig. 63. Simple spiral.

3. **Figure-of-Eight Bandage.**—This bandage, which is one of the most useful for the ambulance student to learn, is applied as follows:—The bandage is fixed to the lower part of the limb by one or two "simple spiral" turns. Turns are then taken successively as shown in Fig. 65. The first half turn ascends on the outside of the limb, the second descends on the inside, overlapping the first, the third ascending parallel to the first, but leaving it uncovered by half its breadth, the fourth descending parallel to the second, but leaving it also uncovered by half its breadth, and so on till the part is completely covered. To apply this bandage neatly, the edges of the layers of bandage should be parallel, and each layer should be overlapped by the same amount. The roller bandage may be secured by splitting

the free end and tying round the limb. Safety-pins may be employed, or what is equally serviceable two ordinary pins inserted at right angles to one another.

Fig. 64.—Reversed bandage.

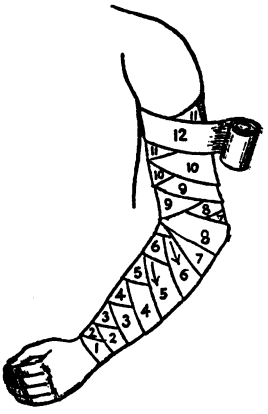


Fig. 65.—Figure-of-eight bandage.

SPECIAL METHODS OF APPLYING THE ROLLER BANDAGE.

1. **The Finger Bandage.**—A narrow bandage is fixed round the wrist by one or two encircling turns. It is then carried up over the back of the hand to the finger to be covered, and is wound in "simple spiral" fashion up close to the point of the finger. The finger is then neatly and firmly covered in by the "figure-of-eight" method from tip to root, the end of the roller being carried back to the wrist and secured there (see Fig. 66).

Fig. 66.
Finger bandage.

2. **Capeline Bandage for the Head.**—For the application of this bandage a double-headed roller is required. This, if a proper double-headed roller be not at hand, may be made by taking two rollers and pinning or sewing their free ends together. The part between the rollers is then applied to the middle of the forehead, and the rollers are carried round the forehead and temple to the back of the head (Fig. 68). The roller held in the left hand of the operator encircles the head.

continuously on this line, and fixes the antero-posterior layer alternately at front and back. The roller held in the right hand is carried backwards and forwards over the head from forehead to occiput until the whole of the head has been covered (Fig. 67). The first of the antero-posterior layers should lie along the middle

Fig. 67.

Fig. 68.

Capeline bandage for the head.

of the head; the second should be carried to the right side of the first, the third to the left side of the first, the fourth to the right side of the second, the fifth to the left side of the third, and so on. The completed bandage is shown in Fig. 69.

3. **Spica of the Shoulder.**—The spica of the shoulder is applied by fixing the bandage by one or two turns to the upper part of the arm close up to the arm-pit. The roller is then covered over the highest part of the shoulder round the back and under the opposite arm. It then crosses the chest and front of the arm, and is passed under the arm-pit and carried up over the shoulder again, but this time on a level lower than the last, so that the shoulder is gradually covered in from above downwards by the turns of the bandage (Fig. 70).

Fig. 69.—Capeline bandage completed.

4. **Spica of the Groin.**—The groin is covered in from below upwards in the following way:—The bandage is fixed to the upper part of the thigh by one or two simple spiral turns. The roller is then carried from within outwards over the front of the thigh and up round the hip and back, and passing over the prominence of the haunch bone on the opposite side, is carried from above downwards in a

sloping direction so as to cross the thigh turn just made. The bandage is then passed round behind the thigh, and is carried up from within outwards parallel to the last layer, but higher by about half the breadth of the bandage, and so on. The hip is in this way gradually covered by layers of bandage from below upwards (see Fig. 71).

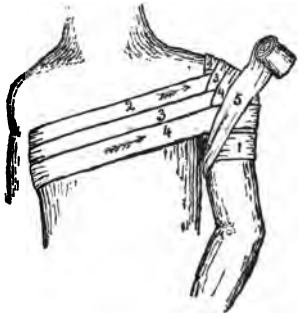


Fig. 70.—Spica of the shoulder.

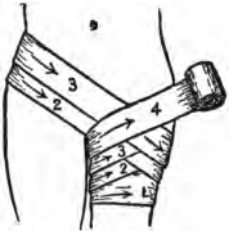


Fig. 71.—Spica of the groin.

5. **Spica of the Breast.**—A breast spica or "suspensory" bandage for the breast is applied by first fixing the bandage round the chest below the breast by one or two turns. From this point of fixation the bandage is then carried under the affected breast and over the opposite shoulder, whence it is

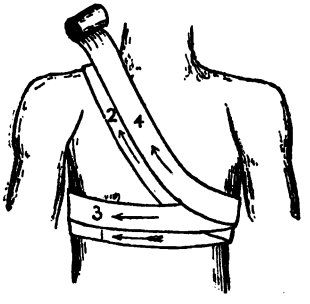


Fig. 72.—Spica of the breast.

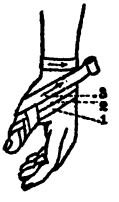


Fig. 73.—Spica of the thumb.

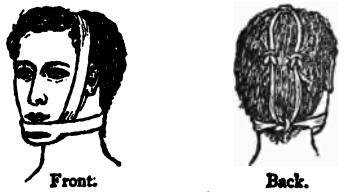
carried down the back and round the chest. The third turn of the bandage passes round the chest, but this time on a level slightly higher than the first turn. The fourth turn passes under the breast and over the opposite shoulder, but this time on a

slightly higher level than the second (see Fig. 72). The breast is thus supported by turns of bandage passing over the opposite shoulder and secured in place by turns encircling the chest.

6. **Spica of the Thumb.**—In cases of dislocation and wounds of the thumb it is often necessary to apply a firm compressing roller bandage, and this is done in the form of the "thumb spica." The bandage is fixed to the limb by one or two turns passed round the wrist from within outwards. The roller is then carried up over the back and outer part of the thumb,

Fig. 74.—Four-tailed bandage.

and forms a loop close up to the nail. It is then passed over the back of the hand, round the front of the wrist, and up again over the back of the thumb to form a second loop, the second loop being nearer the wrist than the last, and leaving the last layer uncovered by about half its width. The ball of the thumb is thus covered in from the point downwards by succeeding layers of bandage (see Fig. 73).



Front. Back.

Fig. 75.—Four-tailed bandage applied to the jaw.

7. **The Four-tailed Bandage for Broken Lower Jaw.**—This bandage is particularly useful in the treatment for broken jaw. A narrow roller bandage is cut in the fashion shown in Fig. 74. The chin is placed in the middle of the bandage. The two lower ends of the bandage are then taken up over the top of the head and tied. The two upper ends are carried round the chin over the lower ends to the back of the head where they are tied, and the four ends are then tied together as shown in Fig. 75.

CHAPTER IV.

FRACTURES.

DEFINITION—CAUSATION—KINDS—SIGNS OR SYMPTOMS OF FRACTURE—HEALING OF FRACTURES—TREATMENT OF FRACTURES—EMERGENCY DRESSINGS FOR COMPOUND FRACTURES—SPLINTS—FRACTURES OF COLLAR BONE, ARM, FOREARM, WRIST, HAND, PELVIS, THIGH, KNEE, LEG, ANKLE, FOOT, RIBS, LOWER JAW, SPINE, SKULL.

To the ambulance student the subject to be dealt with in this chapter is a most important one. Before "first aid" methods can be applied with certainty and success in fracture cases, it is necessary to have a thorough knowledge of the general appearance and shape of the bones. It is desirable that these should be specially studied in the skeleton. It is also a matter of importance for the student to thoroughly master the points of distinction between the different forms of fracture and the signs and symptoms by which one can recognise that a bone has been broken. All that is aimed at in this chapter is to give the reader sufficient instruction to enable him to render "first aid" in cases of accident where a surgeon cannot be readily procured to attend to the injury.

In fractures, as in all other injuries hereafter dealt with, it is understood that a medical man should be sent for at once.

Fracture (Latin, *frangere*, to break) is the name given to the breaking of a bone, whether complete or partial. The injury causing a fracture is generally a severe one, and is easily recognised by the deformity produced; but it should be remembered that in some bones, and especially the bones of the skull, there may be very slight or no displacement. Small fragments of bone may be torn off when a bone is "grazed" by a bullet. The bone may, when struck by a hard nickel bullet, be perforated without being broken across; but if struck by a soft leaden bullet, it is usually splintered or smashed into bony *débris*.

CAUSATION OF FRACTURES.—Fractures are caused mainly in three ways.

1. **Fracture by Direct Violence,** where the force is applied directly to the bone, as in the case of a thigh bone broken by a heavy weight falling upon it.

2. **Fracture by Indirect Violence,** where the bone is broken by a force not applied directly to the part that yields—*e.g.*, when the neck of the thigh bone is broken by a sudden blow on the heel and not by a force directly applied to it at the hip, but transmitted along the leg bones by a sudden jerky fall on the foot, as in the case of a sudden step from a tramway car to the street.

3. **Fracture by Tearing off,** where a part of a bone is torn off by a sudden or violent contraction of a strong muscle—*e.g.*, in transverse fracture of the knee-cap (patella), or by a sudden strain thrown on a strong ligament—*e.g.*, in tearing off of the tip of the brooch bone (fibula) by a forcible twisting inwards of the foot.

KINDS OF FRACTURES.—There are two great classes of fractures—

1. Simple fracture.
2. Compound fracture.

It is of importance to distinguish between these, as compound fractures are much graver injuries than simple fractures, and require extra care in "first aid" and subsequent treatment.

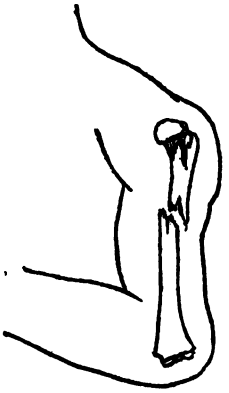


Fig. 76.—Fracture of humerus.

Simple fracture is where a bone has been broken transversely or obliquely across, and where there is no skin wound leading down to the seat of fracture (see Fig. 76).

Compound fracture is where, from extra violence or from rough handling of a simple fracture, one of the broken ends of the bone has been forced through the flesh and skin, thus leaving a tunnel wound communicating with the air, through which foreign materials may reach the broken ends of the bone. Such contamination of the wound is likely to cause blood-poisoning, and forms an additional and very great source of danger to the patient. The danger of severe bleeding is also to be noted in connection with compound fractures, as the broken ends of the bone may tear large blood-vessels. In rendering "first aid" in the case of a "compound fracture," it is, therefore, of importance to secure the purification of the wound by washing, and to prevent the entrance of poisonous matter to the wound

by proper dressings. It should be remembered that a simple fracture may readily be converted into a compound one by clumsy or rough handling. This is particularly the case when the broken bone has a sharp edge under the skin unprotected by soft parts as in the shin.

Where, from the nature of the injury (*e.g.*, in crushing by machinery), the bone at the site of fracture has been very much splintered or broken into small fragments, the fracture is said to be a **comminuted** one. A **complicated** fracture is where, in addition to the break, important structures in the vicinity have been injured. In children, and specially in "ricketty" children, the bones, being composed mainly of cartilage or gristle, tend to bend rather than break. The condition produced is very similar to that of a bent green bough or twig, and is known as a "**green stick**" fracture. In old or debilitated persons, or where the bones are diseased, a bone may break suddenly without violence being applied. This is known as a **spontaneous** fracture.

SIGNS OR SYMPTOMS OF FRACTURE.

1. *Pain*, which is of a peculiar lancinating character, and is generally referred exactly to the site of injury.

2. *Swelling* and a bluish discolouration from bruising of the part.

3. *Deformity*, or an unusual shape of the part. In a fracture of the shin bone for instance, there is an unusual curve between the knee and the ankle.

4. *Inability to use the part.*—This is generally the first sign that attracts attention.

5. *Unnatural mobility—i.e.*, the bone can be moved at a part where it should be quite fixed. In the case of a broken thigh bone there is a sort of "false joint" between the hip and the knee—*i.e.*, there is movement at a part where it does not exist naturally. This is one of the chief signs of fracture.

6. *Crepitus or grating.*—When the two ends of a broken bone are rubbed gently together, a grating sensation is conveyed to the hand holding the limb, and in some cases a grating noise may be heard. This sign, however, should not be sought after except in cases of doubtful fracture, and then only by skilled and gentle hands. It is a sign absolutely diagnostic of fracture.

Healing of Fractures.—A broken bone heals by blood being shed out between and around its broken ends. By the reaction set up at the site of fracture, and by the organisation of

the blood clot into fibrous tissue, there is formed round and between the broken ends a ferule of strong connective tissue. As time goes on lime salts are deposited in this tissue, which becomes converted into bone. The broken bone becomes, after a time, as firm and strong as before the accident. Deposition of lime in the fibrous ferule takes a variable period for its completion, principally depending on the size of the bone and on the extent of the injury. In a weak and aged person the process of healing is slower. Roughly speaking, the time required for the healing of the various bones is as follows :—

Bone of finger (phalanx), two weeks.
Bone of palm (metacarpal), ,,
Bone of instep (metatarsal), ,,
Rib, three weeks.
Collar bone, four weeks.
Forearm bones, five weeks.
Arm bone (humerus), six weeks.
Leg bones, seven weeks.
Thigh bone, ten to twelve weeks.

These points, with regard to the healing of bones, are here detailed for purposes of reference, and more as a matter of interest to the ambulance student than as a necessary part of his knowledge.

TREATMENT OF FRACTURES.

(A) Compound Fractures.

Where the fracture is compound, in addition to the treatment to be detailed below under simple fractures, one must, after checking hæmorrhage, see to the purification of the wound and the prevention of septic matter from entering and causing blood-poisoning. This is secured by washing the wound well at the time of injury with water, and preferably with warm water which has been boiled and allowed to cool down. It is an additional safeguard if an antiseptic or disinfectant substance be added to the water to destroy the poison already introduced into the wound. The best is carbolic acid (a teaspoonful to the half-pint of water) or Condy's fluid diluted with an equal bulk of water. The "emergency" disinfectant, which is most serviceable, and which is usually at hand, is "alcohol," which may be used in the form of a lotion of pure whisky, or whisky diluted with water. Brandy, gin, or methylated spirits may also be used. Other handy disinfectants are turpentine, vinegar, oil of cloves, and a strong solution of common salt. A dressing has

next to be prepared for the wound. The best dressing is a piece of lint or clean rag, soaked in carbolic oil, turpentine, methylated spirits, or whisky. After a careful washing of the fractured wound, the dressing is fixed by a triangular bandage, a layer of cotton wadding or a pad of lint or linen being placed between the dressing and the bandage. The after treatment is exactly the same as in a simple fracture, the limb being "set" and "put up" in splints, as described below.

Different forms of emergency dressings for compound fracture are in use. Professor Ogston prepared, some years ago, a modification of von Lesser's emergency army dressing, in which in small space are to be found an antiseptic dusting powder (iodoform), a pad of wool, bandages, safety-pins, &c., with printed directions for application. This compact little packet can be easily carried about, and nothing better could be desired for an "emergency" dressing in a case of compound fracture. The policemen of Aberdeen are now provided each with a similar packet, which was prepared for them under the direction of Dr. Macgregor and myself, after our lectures to the Force, delivered under the auspices of the Aberdeen Ambulance Association. The packet consists of a waterproof envelope, on which are printed the contents and the method of their use. The packet is a flat one, and is easily carried in the pocket of the constable's tunic. It contains a triangular bandage with safety-pins, boracic lint (to be used either as a sponge for washing wounds or as a dressing), adhesive plaster, and a small flat tin box filled with iodoform ointment, and secured with an elastic band, which is itself utilised in fixing the tongue during "artificial respiration." It is prepared by Messrs. George Reid & Sons, 45 Union Street, Aberdeen. This emergency packet has frequently been employed by Aberdeen policemen, and has specially proved of service in several cases of severe burns treated by them.

(B) Simple Fractures.

General Treatment.—Certain general rules can be laid down which are applicable to the treatment of all fractures. The general method of treating a fracture is to bring the broken ends of bone back into proper relative position. This is known as **setting** the bone. The method consists in pulling gently on the two broken ends until all overriding has been done away with. When the part has been brought back to its natural shape and condition as nearly as possible, it has next to be kept fixed in that position by external supports or splints. This is known as

putting up. Splints are applied to either side of a broken bone, or sometimes all round it, thus acting like a ferule, and are maintained in position by two triangular bandages, fixed one above, the other below the site of fracture. Additional bandages may be employed above and below to fix the limb more thoroughly, and so prevent any chance of movement at the seat of fracture. All splints should be well padded by cotton wool, silk handkerchiefs, or other soft material; if necessity demand, grass, hay, straw, or sand may be used for padding. It is

Fig. 77.—Duncan's rattan cane splints.

generally advisable in fractures of the limbs not to remove the clothing. If it is necessary, for the purpose of deciding whether the bone has been broken, to examine the part minutely, the clothing should not be pulled off, but be cut along the seams with a pair of scissors. The less movement and handling the fractured part has before the application of splints the better.

Splints are ordinarily made of wood, and vary in length, breadth, and shape, according to the bone that is fractured. Surgeons generally employ pine-wood, pasteboard, or poroplastic splints, or encase the part in plaster of Paris bandages. Gooch's army splinting, which consists of strips of lath backed with wash leather, is also very serviceable. Army splints are frequently made of wire, and have the advantage of being light and durable, and not too warm for the patient. Rattan cane splints are also frequently employed, and are advantageous from their lightness and flexibility (Fig. 77). Emergency splints may be easily improvised from materials at hand, as, for example, folded newspapers or periodicals, sword scabbards, straw bottle-covers, ornamental flower-pot covers of wicker-work, packing post paper, stockings stuffed with straw or sand, bark from a tree, twigs rolled in cloth, umbrellas (see Fig. 78), walking sticks, and for the thigh,

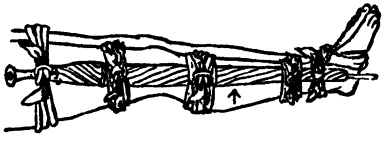


Fig. 78. — Fractured leg splinted with umbrella and other leg. Arrow marks site of fracture.

guns and rifles, billiard cues, skirting boards from walls, &c. One may also utilise one part of the body as a splint for another—*e.g.*, one leg as a splint for the other, the upper jaw as a splint for a broken lower jaw, or the sides of the chest as a means of support

Fig. 79.—Field fracture box (weight about 52 lbs.), containing two jointed thigh splints, wood; one set leg splints, right and left, wire; one set leg splints, right and left, wood; half set Pott's splints, wood; one set Pott's splints, wire; six pasteboard splints; one radius splint, wire; one double inclined plain, wire; 1 lb. plaster of Paris, in ¼-lb. tins; ¼ lb. cotton wool, antiseptic; ½ lb. tow, carbolised; 2 yards flannel serge of open texture, antiseptic; 2 yards guttapercha tissue; twelve loosewove bandages; twelve triangular bandages, plain; twelve straps with buckles; one old linen sheet; one counter extension apparatus; one set gypsum bandage instruments in case.

for a broken upper arm. Fig. 79 shows Messrs. Evans & Wormull's field fracture box, which contains all the necessaries for the treatment of the different fractures. Wooden, wire,

jointed long splints, and plaster of Paris bandages for application in fracture cases, are arranged so as to be packed in small compass and easily carried. The weight of the field fracture box is only 52 lbs.

SYMPTOMS AND TREATMENT OF SPECIAL FRACTURES.

1. **Fracture of the Clavicle or Collar Bone.**—The collar bone is generally broken at the junction of its inner and middle thirds by a heavy fall or blow on the shoulder.

Symptoms.—There are the ordinary signs of fracture as detailed on p. 51. The patient is generally found supporting the elbow of the injured arm with his hand, as shown in Fig. 80.

Treatment.—Three triangular bandages are required.

(1) Fold up a triangular bandage into a neat pad and place it in the arm-pit, so as to force outwards the outer fragment of the broken bone.

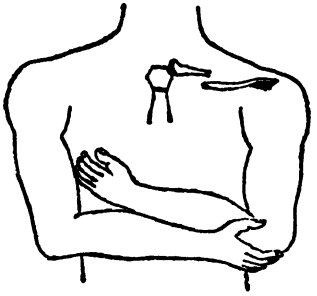


Fig. 80.—Fractured collar bone.

(2) Apply a second bandage as a large arm sling. Pull on the ends of the bandage until the weight of the injured arm is taken off the shoulder, and until the arm is sufficiently raised to bring the two ends of the broken collar bone into proper position, and to remedy the deformity.

(3) Take a triangular bandage folded as "narrow cloth," place its middle over the elbow of the injured arm outside the sling, and carry its ends round the chest to fix the arm firmly against the side, and so with the leverage of the pad in the arm-pit to force the outer fragment outwards. This brings the two ends of the broken bone into proper position (see Fig. 81), and prevents overriding at the site of fracture.

2. **Fracture of the Arm.**—*Symptoms.*—The ordinary signs of fracture.

Treatment.—The "first aid" treatment consists in applying either four or five narrow splints surrounding the limb, or better, two broad firm splints applied, one on the inside, the other on the outside of the arm. Extemporised splints in the form of folded newspapers, magazines, straw bottle covers, or ornamental flower pot covers may be employed (see Fig. 84).

If wooden splints be employed, they should be padded if placed next the skin, and unpadded if applied over the clothes. The

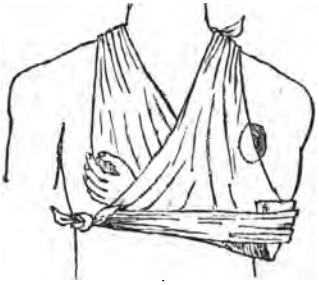


Fig. 81.—Fractured collar bone treated with bandages and arm-pit pad.

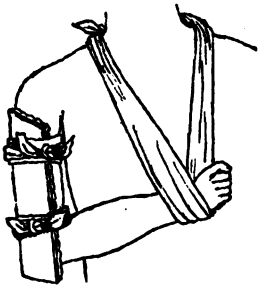


Fig. 82.—Method of treating fractured arm.

splints should be fixed by two "narrow fold" triangular bandages applied tightly, one on each side of the fracture (Fig. 82).

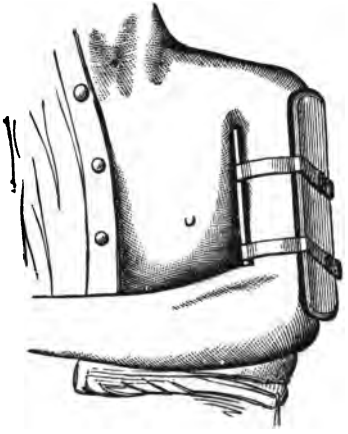


Fig. 83.—Splints applied to fractured arm.

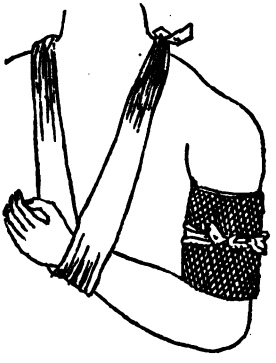


Fig. 84.—Fracture of humerus. Flower-pot ornament as splint, secured with triangular bandage.

The arm should be supported by a narrow arm sling. The large arm sling if used tends to force the lower part of the bone upwards, and cause overriding of the broken ends.

3. **Fracture of the Forearm.**—*Symptoms.*—The ordinary

signs of fracture. Pain will be elicited on pressing the two forearm bones gently together.

Treatment.—The treatment is the same, whether the fracture be of both bones of the forearm or of one only. Splints are applied on the front and back of the forearm, the arm being semi-supinated—*i.e.*, turned with the thumb upwards (see Fig. 85). The splints must be padded if placed next the skin, and are fixed by triangular bandages applied firmly on either side of the fracture. The arm is then supported in a large arm sling.

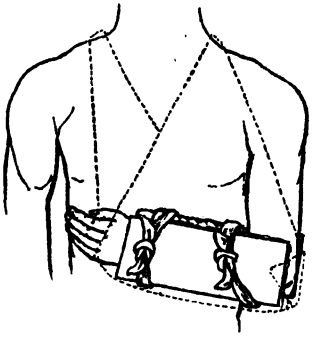


Fig. 85.—Fractured forearm in splints.

4. **Fracture at the Wrist.**—A fracture at the wrist is not an uncommon result of a fall, the arm being outstretched to break the fall, and the patient striking the ground first with the palm of the hand. It is generally the lower end of the radius that is broken.

Symptoms.—The signs are those of an ordinary fracture, and the hand is generally pulled towards the radial or thumb side. The deformity is well marked.

Treatment.—Pull gently on the hand to get the bones into proper position. Apply splints on the front and back of the forearm, the front one reaching from the wrist to the elbow, the back one from the knuckles to the elbow. Fix these by a palm bandage, and by two forearm bandages, and sling in a large arm sling.

5. **Fracture of the Hand.**—For any fracture of a metacarpal bone or phalanx, cut a piece of cardboard to fit the palm of the hand, including the fingers. Fix the splint by a palm bandage, and support the hand by a narrow arm sling.

6. **Fracture of the Pelvis** generally takes place at the front of either or both haunch bones, and is caused either by a fall from a height or by a compressing force—*e.g.*, a person being "boxed" against a wall by a bull or run over by a carriage. The bladder and other internal organs are often injured in this fracture, and these complications form one of its chief dangers. If pelvic fracture be suspected from the history of the accident the patient should be carefully lifted, carried on a stretcher, and placed in bed. A broad flannel bandage should be firmly applied round the pelvis. Medical aid should be at once summoned.

7. **Fracture of the Thigh Bone.**—*Symptoms.*—The thigh bone is fractured either at its neck or at some point in its shaft. The fracture at the neck is caused by a fall on the hip, or in old people by indirect violence, the force acting from the foot along the leg, when the foot suddenly strikes the ground, as in stepping suddenly from a cab or tramway car. In the case of the shaft the fracture is usually caused by direct violence applied to the bone. In addition to the ordinary symptoms of fracture, there may be noticed in the case of a broken thigh bone, a shortening of the limb by one to three inches, while the leg usually lies with the foot everted—*i.e.*, with the outer border of the foot turned towards the ground or couch.

Treatment.—The "first aid" treatment consists in applying a splint to the outer side of the leg, long enough to reach from the arm-pit to 2 or 3 inches below the foot. The thigh should be securely bandaged to the splint by two triangular bandages, one above and one below the seat of fracture, and the splint should be fixed firmly by additional bandages, one at the foot, a second a little below the knee, and a third round the chest at the upper part (Fig. 86). For additional security the injured should

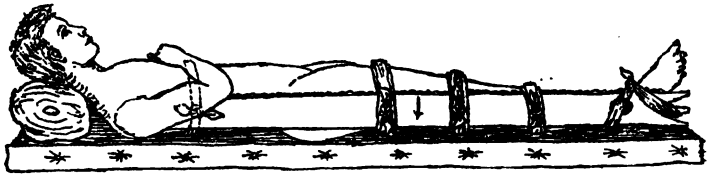


Fig. 86.—Thigh fractured at ← and put up with a Liston's long splint.

be fixed to the sound limb by two bandages, one applied at the upper, the other at the lower part of the leg. The patient should not be lifted, if possible, until splints have been applied in the method described. Extemporised splints may be used in the form of a rifle, a billiard cue, a broom-handle, a paling post, or part of the skirting board of a room.

8. **Fracture of the Knee-cap** is caused either by direct violence applied to it, or by a strong and sudden contraction of the muscles in front of the thigh, causing a "fracture by tearing off." In the former case there is considerable swelling, but not much deformity, in the latter a distinct gap can be felt between the fragments.

Treatment.—Bandage the knee with a triangular bandage in the way already described. Apply along the back of the limb a

long splint reaching from the buttocks to the heel, and fix it by four triangular bandages, two of which encircle the limb immediately above and below the knee-cap. If a long splint cannot be easily got, apply to the back of the knee a folded newspaper or periodical, and fix it with the knee bandage, then bandage one leg to the other.

9. **Fracture of the Leg.**—*Symptoms.*—The symptoms are those of ordinary fracture. Pain is elicited on gently pressing the two leg bones together. The tibia and fibula may be broken at any part of their shafts, and may be broken separately or together. A frequent fracture of the brooch bone or fibula is at its lower end, and is caused by a sudden twisting of the foot either outwards or inwards. Owing to the bones of the leg lying so close to the skin a simple fracture of the leg may be readily converted into a compound one by faulty handling, as by carrying the patient with the leg unsupported by splints. This is particularly the case in fracture of the shin bone. It is, therefore, advisable that splints be applied before the patient is lifted from the ground.

Treatment.—Splints should be fixed on either side of the leg by two bandages, which are applied one above, the other below, the site of fracture (see Fig. 87). The two legs should then be bandaged together, to afford additional support. Improvised splints may be used in the form of umbrellas, walking sticks, packing post paper, books, periodicals, folded newspapers, stockings filled with sand, &c. Army splinting may be employed and is very serviceable, and the method of its application is shown in Fig. 88.

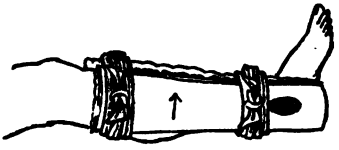


Fig. 87.—Fractured leg treated by external and internal splints. Arrow marks site of fracture.

10. **Fracture at the Ankle.**—This is generally of the lower end of the brooch bone, and is to be treated like a leg fracture. It is generally caused by "going over" the side of the foot.

11. **Fracture in the Foot.**—This is generally of a metatarsal bone or phalanx.

Symptoms.—Pain on pressure, and crepitus.

Treatment.—A soft pad should be placed on the painful part and fixed by a bandage. The part should be rested.

12. **Fracture of the Ribs.**—*Symptoms.*—There will be a history of compression of the chest-wall by the patient being run over, or sustaining a blow or heavy fall on the side. Severe

pain on the injured side will be complained of, generally described as a "stitch." It is caused by the two ends of the broken rib rubbing on each other. The pain will be increased by pressure on the side with the hand, or by the patient taking a deep breath. Fracture of the ribs is often complicated by the broken

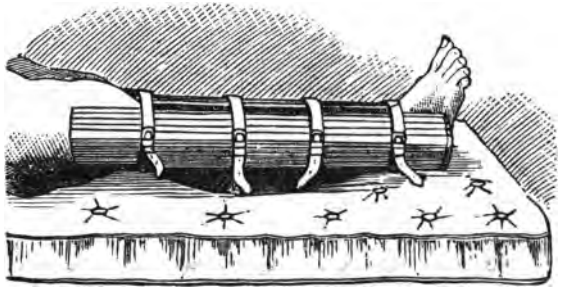


Fig. 88.—Army splinting applied to fractured leg.

ends being driven into the lung. This is shown by the collapsed condition of the patient, by his difficulty of breathing, and, it may be, by spitting of blood.

Treatment.—Support the chest-wall by two or three triangular bandages tied tightly round it, or by a flannel binder or "bolster-slip," if that can be procured.

13. **Fracture of Lower Jaw.**—*Symptoms.*—The jaw, generally from a fall or blow, is broken at its weakest part, about three fingers' breadths behind its middle. The patient is unable to speak or move the jaw without extreme pain. The line of the teeth is broken. Bleeding from the mouth will often be present, and crepitus is easily made out.

Treatment.—The lower jaw is fixed to the upper jaw—which is the best splint for it—by a triangular bandage applied in either of the two methods already described (Figs. 44, 45, and 46), or by the four-tailed bandage (Fig. 75).

14. **Fracture of the Spine.**—*Symptoms.*—There will be the history of a severe accident, a fall from a height, a severe blow on the back, or a crushing of the spine, as by a carriage or traction engine passing over the body. The special danger of the accident consists in the possible injury to the spinal cord (see Fig. 89). Pressure on the spinal cord by the narrowing of the spinal canal by broken pieces of a vertebra, or by one vertebra being driven off another, will cause paralysis of all the muscles below the seat of injury. Both legs will then be

helpless, which may be tested by tickling the soles of the feet, when the patient will be unable to draw his legs up.

Treatment.—If from the history and the extent of the condition of the patient, fracture of the spine be suspected, the patient must be moved most carefully. He should be lifted *en masse*, the spine being kept as straight as possible. If he has to be

Fig. 89.—Fracture of spine with nipping of cord.

carried, it is best done on a door or shutter, to prevent bending of the spine. He should be placed in bed on a straw mattress. All that one should aim at in "first aid" is to prevent further injury to the spinal cord by keeping the spine as rigid as possible.

If the patient suffer from shock, a condition of nervous disturbance or depression following a severe injury, stimulants may be administered with caution.

15. **Fracture of the Skull.**—The skull may be fractured on the vault or top, or on its lower surface or base.

(*a*) Fracture of the Vault.

Symptoms.—There will be a history of a blow sustained on the vault, of a heavy body having fallen on the head, or of a fall from a height upon it. There will generally be a scalp wound of greater or less extent leading down to the seat of fracture. The surface of the skull may be simply fissured or cracked, but in more severe cases the bone at the place of injury is driven in so as to be below the level of the bone around. It is then known as a "depressed" fracture. The danger of such a fracture consists in direct injury to the brain, in the tearing of its membranes, and in the compression of the brain by the depressed piece of bone, or by the clotted blood shed at the time of the accident between the skull and the brain (see Fig. 90). The patient, if conscious, will complain of pain at the injured part, but in severe cases will be either partially or wholly unconscious.

Treatment.—As the condition is a grave one, the sooner the patient is seen by a medical man the better. Do not on any account give the patient a stimulant—the favourite treatment by the uninitiated for every form of accident—as it is more than likely to cause fresh bleeding, and increase the pressure on the brain substance, from which the patient may be already suffering.

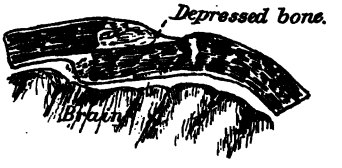


Fig. 90.—Depressed fracture of skull.

Conduct the treatment of such a case in the following order:—

(1) If there be a surface wound wash it with water, or with a disinfectant solution, as described under compound fracture. Place a cold compress or dressing over the wound, and fix with a bandage.

(2) If the patient has to be carried to a house or hospital, procure or improvise a stretcher (*q.v. infra*), and carry him with his head raised on a pillow, so that it is on a higher level than the rest of his body.

(3) When he is put into bed, his head should still be kept high, and a clean towel placed below it to prevent soakage of the pillow.

(4) Hot bottles should be placed beside him, and should be covered with stockings or with flannel to prevent the skin being burned, as may readily happen if the patient be insensible.

(5) Towels wrung out of cold water should be applied to the head and frequently changed.

(*b*) Fracture of the Base of the Skull.

Symptoms.—There is a history generally of a fall on the top of the head. The base of the skull is fractured by the upper part of the spine being driven forcibly against it. The prominent symptoms are bleeding from the nose and ears, dilatation or contraction of the pupils ("the black") of the eye, and unconsciousness.

Treatment.—1. Keep the head high.

2. Apply towels wrung out of cold water over the head and frequently change them.

3. Hot bottles should be used, with the precautions beforementioned.

4. No stimulant should be given.

CHAPTER V.

DISLOCATIONS AND SPRAINS.

DISLOCATION: DEFINITION—VARIETIES—SYMPTOMS—TREATMENT—SPRAINS: DEFINITION—SYMPTOMS—TREATMENT.

Dislocations.—A dislocation is a displacement of the bones at a joint, and is caused by violence applied in such a way as to force apart the joint surfaces and drive the head of the bone through a weak part in the ligamentous capsule of the joint into the structures outside—*e.g.*, in dislocation of the hip joint, the head of the femur leaves the cup in which it naturally lies, and is forced through the capsule of the joint either backwards or forwards on to the haunch bone. Fig. 91 shows the backward dislocation of the head of the femur. In severe cases, fracture of the bones at the joint may occur along with the dislocation, and this not uncommonly happens in the ankle, where, in addition to the displacement at the joint, the ends of the tibia and fibula are broken. The most common situations in which dislocations occur are the fingers, shoulder, elbow, ankle, hip, and jaw.

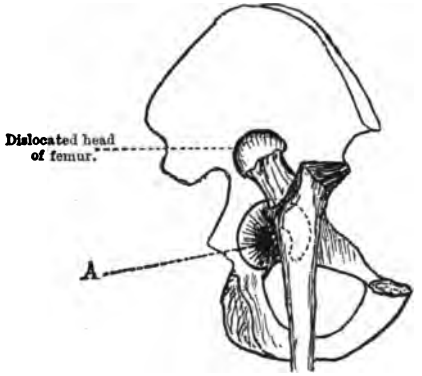


Fig. 91.—Dislocation of hip joint. A, cup in which head of bone should lie.

Symptoms.—The symptoms are not unlike those of fracture. There is deformity, swelling, and inability to use the part. A grating sound may sometimes be made out, but it is not the true crepitus of fracture. It is worthy of notice that in a dislocation the part is fixed where it should naturally be movable, whereas in a fracture there is, as has been explained, unnatural mobility or movement where none should exist.

Treatment. — The treatment of a dislocation consists in "reducing" it—*i.e.*, in manipulating or pulling the dislocated bone back into its proper relative position. Such manipulation in the case of a large and important joint requires special skill and training, and should not be attempted by an ambulance student. The first aid treatment consists in preventing further injury, and in relieving pain by fixing the dislocated joint securely by bandages, and, if necessary, binding the limb to a splint.

In the case of dislocation of the phalanx of a finger or thumb, an attempt may be made to bring the parts back into position by pulling on the dislocated phalanx, which should immediately return with a snap into its natural position. If this result is not at once attained, the part should not be roughly pulled on, but should be left for the inspection and treatment of a medical man. In dislocation of the lower jaw, if a medical man cannot be soon in attendance, the ambulance pupil may endeavour to reduce the dislocation by pressing on the back teeth of the lower jaw with his thumbs, the pressure being directed downwards and backwards. The thumbs should be covered with a handkerchief or towel to prevent their being bitten. If pressure be properly applied, the jaw will go back into position with a jerk.

Sprains.—A sprain is a "missed dislocation," and consists in a stretching and tearing of the ligaments of a joint by a force insufficient to cause a dislocation. The joint in which it is most usually seen is the ankle.

Symptoms.—With the history of the injury there is also considerable pain and swelling. The part is usually discoloured from the blood effused from the torn structures. There may be an effusion of blood into the joint, which renders the part very painful on movement.

Treatment.—The joint should be covered with cotton wadding or folded triangular bandage, and firmly bound with a "cravat" bandage, or, preferably, with a roller bandage applied firmly in the "figure-of-eight" method. If the pain be very great, and a medical man cannot at once be got, relief may be given by applying a linseed or oatmeal poultice, on the surface of which may be sprinkled a teaspoonful of laudanum.

CHAPTER VI.

HÆMORRHAGE.

INTERNAL AND EXTERNAL HÆMORRHAGE—THE ARTERIAL SYSTEM—THE VENOUS SYSTEM—KINDS OF BLEEDING—TREATMENT OF HÆMORRHAGE—ABUSE OF STIMULANTS IN THE TREATMENT OF HÆMORRHAGE—TREATMENT OF CAPILLARY BLEEDING—STYPTICS—TREATMENT OF VENOUS BLEEDING—TREATMENT OF ARTERIAL BLEEDING—POINTS OF COMPRESSION OF THE MAIN ARTERIES OF THE BODY—METHODS OF ARRESTING HÆMORRHAGE FROM THE MORE IMPORTANT ARTERIES—VOMITING AND SPITTING OF BLOOD—BLEEDING FROM THE NOSE—BLEEDING FROM THE SOCKET OF A TOOTH—BLEEDING FROM HÆMORRHOIDS—BLEEDING FROM THE EAR—BLOOD IN THE URINE—HÆMOPHILIA—INTERNAL HÆMORRHAGE—COLLAPSE FROM HÆMORRHAGE.

Hæmorrhage (from the Greek words signifying "flowing of blood") is the name given to an escape of blood from large or small blood-vessels, either **externally** from wounds or **internally** into the tissues, organs, or cavities of the body. **Internal** hæmorrhage is not a subject which requires to be dealt with at length in an ambulance text-book. So far as it is a matter of interest and importance for the ambulance student it will be touched on at the end of this chapter, and will meet us again in the section dealing with apoplexy. **External** hæmorrhage, however, is a matter of the greatest importance and must be exhaustively treated. Before one can thoroughly understand the different forms of bleeding and the rationale of their treatment, it is necessary to have some idea of the structure and relative anatomy of the main blood-vessels. From what has been already said in the description of the circulation of the blood it will have been seen that the pure arterial blood leaves the left ventricle of the heart to supply nourishment to the tissues by a large blood-vessel known as the **aorta**. This large blood-vessel sends off branches to the head and neck and to the trunk and limbs. All such blood-vessels containing pure blood for the nourishment of the tissues are known as **arteries**. The arteries have thick walls which contain muscular fibres, so that through nervous influence they have the power of dilating and contracting. This is of importance in connection with the arrest of hæmorrhage. An artery, if cut only partly across, tends from the contraction of these

muscular fibres to gape, and through the open wound so formed in the vessel a large stream of blood will escape. On the other hand, if the vessel be divided transversely across, the cut ends tend by their contraction to be drawn upwards and downwards respectively into the sheath or covering of the artery, and to curl up inside it, with the result that less blood escapes through the contracted and retracted ends. The method by which nature arrests bleeding is by the formation of a clot in the cut end of the vessel.

The large arteries given off by the aorta divide and subdivide to supply the muscles, bones, and superficial structures of the body. The ultimate small ramifications of the arteries are known as **arterioles**, and divide into a regular net-work of very minute microscopic blood-vessels known as **capillaries**. From the capillaries the blood nourishes the tissues, giving up its nutritive properties to them, while it in turn takes up into these small vessels the waste products formed by the wear and tear of the tissues. Thus the blood running in a pure form in the arterial capillaries is rendered impure in the tissues, and passes through a small net-work of venous capillaries to the vessels which are to convey it back to the heart. The returning vessels are known as **veins**. Beginning as small veins, similar in size to the arterioles, they gradually unite into large blood-vessels which run along with the main arteries of the limb and pour their contents into two large veins known as the **superior** and **inferior venæ cavæ**, which enter the right auricle of the heart. The veins have much thinner walls than the arteries, and have little power of contraction. This is a matter of importance, as the escape of blood from a large cut vein would be much more serious than that from an artery were it not for the fact that the blood pressure in the veins is very much less, and the return current in them is much more sluggish and less powerful than in the arteries which have blood pumped into them directly from the heart.

Before going on to the description of the different forms of bleeding and their treatment, it is essential that a detailed description be given of the anatomical "lines" and relative position of the main arteries and veins of the body.

ARTERIAL SYSTEM.—The **aorta**, the largest artery of the body, after leaving the left ventricle of the heart forms an arch (see Fig. 93), and passes down in front of the spine lying on the front of the bodies of the vertebræ. In its course it gives off branches to supply arterial blood to the walls of the thorax

and abdomen, and large branches to the liver, stomach, kidneys, and intestines (see Fig. 23). It divides opposite the fourth lumbar vertebra into two branches, known as the **common iliac arteries.** Each of these again divides into two branches—the **internal** and **external iliac arteries,** the internal passing down into the pelvis, the external directly to the upper part of the thigh, where it takes the name of the **femoral** or **thigh artery** (see Fig. 93).

Arteries of the Leg (see Figs. 92*a* and 93).—The femoral artery passes down the front and inner side of the thigh, and at the junction of the upper two thirds with the lower third, dips behind to lie in the middle of the space at the back of the knee joint, known as the "ham." It is there called the **popliteal artery.** The line of the femoral artery is from the middle of the groin or upper part of the thigh down to the middle of the inner side of the knee joint. The popliteal artery, at its lower part, lies directly in the middle of the ham, and divides immediately below the knee joint into two branches, which run down the back of the leg, the one on the tibial or inner side being known as the **posterior tibial artery,** the one on the fibular side as the **peroneal.** From the posterior tibial artery a branch passes forwards between the tibia and fibula, at the upper part of the leg, to nourish the structures on the front of the limb, and is known as the **anterior tibial artery.** The posterior tibial artery passes behind the posterior edge of the tibia at the inner side of the ankle into the sole, where it forms an arch close to the ball of the toes, from which branches are given off to supply the toes. This arch is known as the **plantar arch.** Roughly, then, it may be said that on the thigh, where there is one long bone, there is one main artery running along it, while the two bones of the leg have each a corresponding artery, the inner of which gives off a branch to supply the front part of the leg, and forms an arch on the sole of the foot, from which is derived the blood supply of the toes. A similar arrangement will be found to obtain in the case of the arteries of the arm and forearm.

Arteries of the Arm (see Figs. 92 and 93).—From the arch of the aorta spring large arteries to supply the head and the arms. The main artery of the arm passes from the aortic arch between the first rib and the clavicle into the arm-pit. It lies directly on the first rib and can be compressed against it, and is known as the **subclavian artery.** In the arm-pit or axilla it becomes the **axillary artery.** It runs down the inner side of the arm to the middle of the front of the elbow. From the

arm-pit to the elbow it is known as the **brachial artery,** and its line is from a little in front of the middle of the arm-pit to the middle of the elbow—*i.e.*, along the inner border of the biceps muscle, or, roughly speaking, "along the line of the seam of a coat sleeve." The brachial artery divides in the middle of the front of the elbow into two branches which run down the front of the arm along the radius and ulna, the former termed the

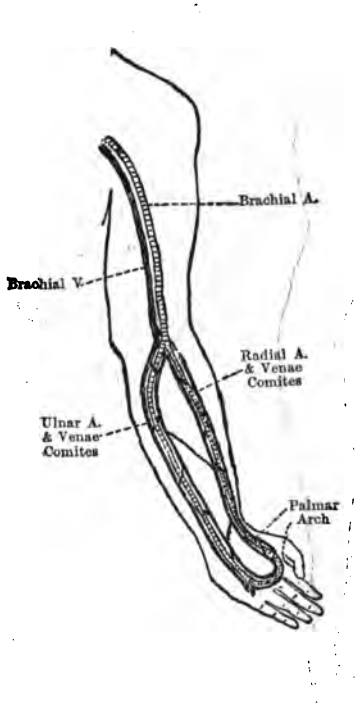


Fig. 92.—Arteries and veins of left arm. Arteries with cross markings. Veins black.

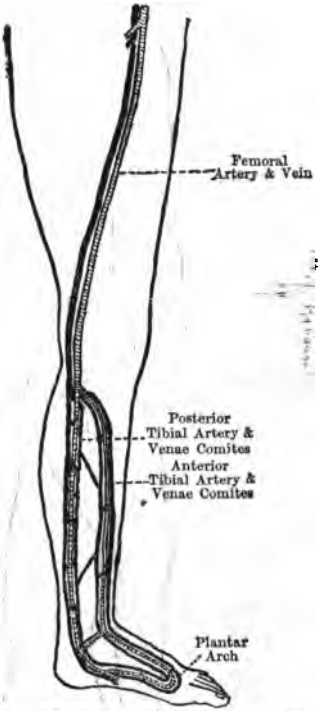


Fig. 92*a*.—Arteries and veins of left leg. Arteries with cross markings. Veins black.

radial, the latter the **ulnar artery.** The beating of the pulse at the wrist is due to the filling of the radial artery. The ulnar artery passes over the wrist and enters the palm, where it joins with a small branch from the radial and forms an arch (**palmar arch**), branches from which supply the fingers. The ulnar artery

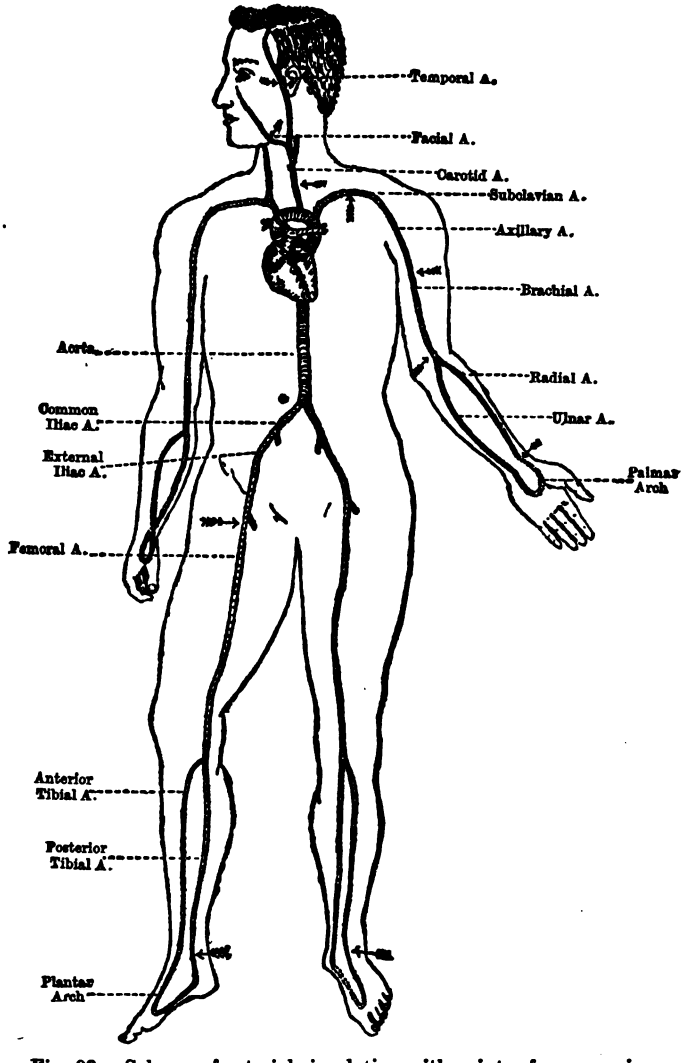


Fig. 93.—Scheme of arterial circulation with points of compression marked by arrows.

gives off a branch at its upper part which passes between the bones to supply the back of the forearm.

Arteries of the Head and Neck (see Fig. 93).—From the arch of the aorta there passes up a large artery on each side to supply the face and neck structures, and the brain. These are known as the **carotid arteries**, and the line of their course is, roughly speaking, from the junction of the collar bone and breast bone to the angle of the lower jaw. The carotid arteries may be readily compressed against the transverse processes of the vertebræ on which they lie. From the carotids are given off branches to supply the brain, tongue, face, neck, and scalp. It is important that the ambulance student should know the course of the two special branches of the carotid arteries known as the **facial** and **temporal arteries**, as bleeding from the trunks or branches of these is not uncommon. The facial artery may be readily compressed against the lower jaw, which it crosses two fingers' breadths in front of its angle. It runs up over the cheek, and in addition to other branches gives off the coronary arteries which run in the substance of the upper and lower lips. The temporal artery may be felt pulsating a finger's breadth in front of the opening of the ear, where it is easily compressed (Fig. 93).

THE VENOUS SYSTEM.—The veins are the blood-vessels which return to the heart the blood which has been rendered

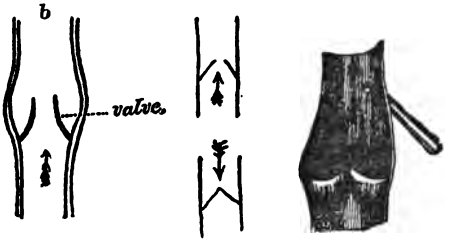


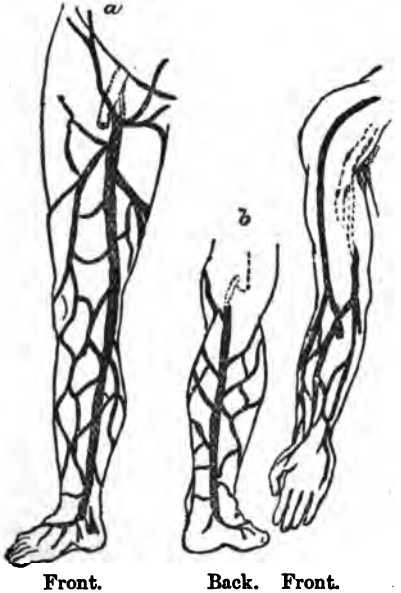
Fig. 94.—Valves in veins.

impure in the tissues. The blood, therefore, while it runs in the case of the extremities *down* the arteries, has an *upward* course in the veins. In the neck the arterial blood *ascends* to the brain, &c., while the returning venous blood passes *downwards* to reach the heart. Veins may be divided into two great classes :—

I. Superficial Veins.
II. Deep Veins.

I. Superficial Veins.—These veins run in the tissues which immediately underlie the skin. They are provided with valves to assist in supporting the blood column. These valves (Fig. 94) form little pockets on the side of the vein and allow the blood current to pass upwards in a partially filled vein, but when the vein is full they are pushed together towards the centre of the vessel so as to occlude its lumen and support the column of blood in the vein. The most important of the superficial veins are the following:—

1. **The Internal Saphena Vein.**—It runs down from the middle of the thigh behind the knee, and along the inner side of the leg, passing in front of the ankle to the foot (Fig. 95). This vein is frequently dilated or varicose.



Front. Back. Front.

Fig. 95.—Superficial veins of leg and arm.

2. The superficial veins of the forearm join in front of the elbow to form two large veins, which run up the sides of the upper arm (Figs. 95 and 96).

3. The **External Jugular Vein**—the superficial vein of the neck—runs from just in front of the ear down to the middle of the collar bone, under which it dips.

II. Deep veins are the veins which accompany the large arteries and lie in the tissues considerably deeper than those just described. The large vein running with the carotid artery is known as the internal jugular vein. In the upper and lower limbs the arrangement of the deep veins is practically the same, and they receive the names of the arteries with which they run. In the thigh and upper arm the main artery has a large vein running along its inner side. In the leg and forearm each of the two arteries has venæ comites, or accompanying veins—*i.e.*, a vein on either side (see Figs. 92 and 92*a*).

KINDS OF BLEEDING.—There are three varieties of bleeding:—

1. **Arterial Bleeding, or Bleeding from a Cut Artery.**—The blood from a cut artery spurts out in jets with each heart beat (Fig. 97). It is bright red in colour, and comes from the end of the vessel which is nearer the heart — *e.g.*, if the radial artery be cut transversely at the wrist, where it is popularly known as the pulse, the blood will issue from the end of the artery nearest the elbow, as will be readily understood when one remembers that the current of blood is running in the artery from the elbow towards the hand. The amount of blood lost during each heart beat will depend on the size of the artery and position of the wound in it, also on the force of the heart beat and the duration of the bleeding. If the bleeding has gone on for some time, the flow from the artery, instead of being a jet, will be a mere trickle.*

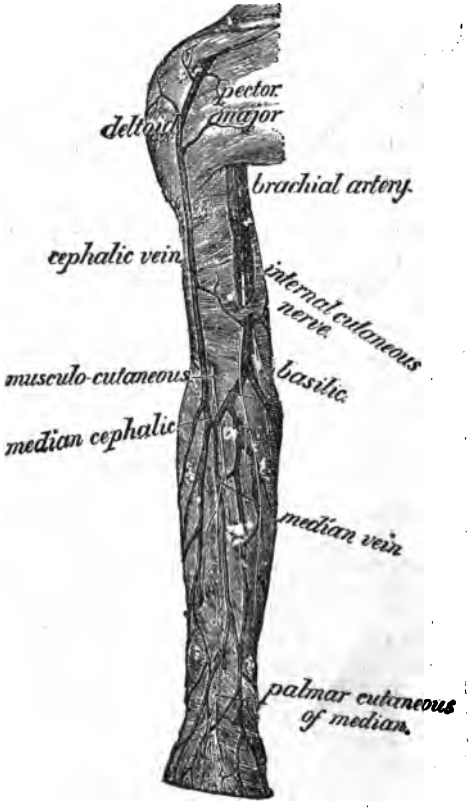


Fig. 96.—Superficial veins of arm and forearm.

2. **Venous Bleeding or Bleeding from a Cut Vein.**—The blood from a cut vein is of a purplish colour—much darker than arterial blood—and comes from the end of the cut vessel furthest from the heart. It does not jet or spout as in arterial bleeding,

* Bleeding from an artery of the face or scalp is at first very alarming, but rapidly subsides, and is easily controlled by pressure.

but issues in a continuous flow. When a large vein is cut, as in the operation of venesection or "bleeding" from one of the large superficial veins of the arm, the column of blood may, from the pressure in the vessel, rise some inches from the limb, but the flow is steady and not jerky. The superficial veins of the lower extremity, from the insufficiency of their valves and the pressure on their walls of the long column of blood, tend to dilate or become "varicose," and may even in extreme cases burst. Venous bleeding may jet like arterial if the cut vein lies immediately over an artery, the pulsation being conveyed to the vein from the artery below.

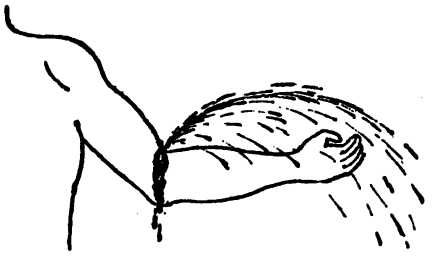


Fig. 97.—Cut artery spouting.

3. **Capillary Bleeding.**—Blood from cut capillary vessels is reddish in colour, and the bleeding consists of a steady flow or ooze. It is best exemplified by the bleeding from the socket of a tooth recently extracted, or the ooze from a cut made in shaving.

TREATMENT OF HÆMORRHAGE.—Abuse of Stimulants in the Treatment of Hæmorrhage.—It is the unfortunate custom in many parts of the country to give to the suffering patient in all forms of accident, as a universal remedy, a quantity of stimulant in the form of brandy or whisky. While this may in certain cases of injury, such as burns, be of service and indeed be necessary, nothing more injurious can well be imagined in cases of extensive hæmorrhage, either external or internal *where the hæmorrhage is not arrested, and is not under control.* By the administration of stimulants in such cases, the heart is made to beat faster and a larger amount of life's vital fluid is forced with greater rapidity through the wound in the vessel. In all cases of hæmorrhage, before a stimulant is administered, it should be well seen to that the bleeding has been arrested, and that means have been taken to prevent its recurrence. If collapse from hæmorrhage occur with the symptoms described under that heading at the end of this chapter, it will be advisable to administer stimulants, but only under the conditions there stated.

Treatment of Capillary Bleeding.—Most cases of capillary

bleeding can be treated satisfactorily by pressure. The method consists in pressing on the bleeding point firmly with a clean sponge or piece of lint or linen. The pressure should be kept up continuously for two or three minutes. If pressure be not sufficient to arrest the bleeding, it may be necessary to call in the assistance of styptics. Styptics are substances which have the property of assisting the formation of a blood clot, and so of arresting bleeding. The following are the styptics most commonly in use, with the method of their application :—

1. *Hot Water.*—A sponge or piece of lint wrung out of water as warm as can be borne by the hand may be firmly applied to the wound.

2. *Cold Water.*—A sponge or compress of lint or linen wrung out of cold water may be employed. This is useful in cases of bleeding from the nose, cold compresses being applied over the bridge of the nose. If this fail, the nostrils should be firmly plugged with lint or cotton wadding wrung out of cold water.

3. "*Steel Drops*" (tincture of perchloride of iron) form an excellent styptic, though slightly painful. A few drops should be applied on a handkerchief to the wound.

4. *Burnt or Dried Alum* (alumen exsiccatum) is also very serviceable as a styptic. It may be applied to the wound as a powder or in solution. It is particularly useful in bleeding from the socket of a tooth recently extracted, and is applied on small pledgets of cotton wool with which the socket is firmly plugged.

5. *Turpentine* may be applied on linen.

6. *Common Salt*, either applied in crystals or as a strong solution, also acts as a styptic.

7. *Nitrate of Silver* ("lunar caustic") has also been employed for this purpose.

8. *Tannic Acid* may be dusted as a powder on the part, or a little of the glycerine of tannic acid may be smeared over the bleeding surface. A very strong infusion of tea will serve the purpose, if pure tannic acid be not at hand; the tannin in strong tea, having astringent properties, will help coagulation.

9. *Gallic Acid* may be used in the form of a powder dusted on the part.

Treatment of Venous Bleeding.—Bleeding from a cut vein may be arrested by any of the following methods :—

1. *By Digital or Finger Pressure.*—If the wound be a small one pressure with a finger or thumb will usually be sufficient.

2. *By Compression.*—In the case of bleeding from a small vein, all that is necessary, as a rule, is to place a firm pad of lint or linen over the wound, and bandage it firmly by a "narrow

fold" triangular bandage. Thereafter the limb should be raised to diminish the amount of blood supplied to the part.

3. *By a Tourniquet.*—In the case of bleeding from a large vein, the measures mentioned above may be insufficient. It may then be necessary to apply a constricting band or tourniquet to the vein. The tourniquet should, of course, be applied on the side of the vein furthest from the heart—*e.g.*, in the case of a cut vein of the calf of the leg, the constricting bandage should be applied between the cut and the foot. In bleeding from a large severed vein or burst varicose (Fig. 98), first apply pad pressure,

Fig. 98.—Varicose vein of leg.

and if that be found insufficient and soakage still go on, apply the tourniquet as directed. In severe bleeding, where it is not at once evident whether the hæmorrhage is arterial or venous, a tourniquet should be applied to the main artery of the limb, as described below.

Treatment of Arterial Bleeding.—Bleeding from an artery may be arrested, according to the severity of the bleeding, by one or other of the following methods:—

1. *Elevation.*—In the case of bleeding from an artery of the leg or arm, the arrest of hæmorrhage will always be assisted by elevating the limb, and thereby diminishing the amount of arterial blood passing to the part. In the case of arterial bleeding from the leg, the method of elevation is carried out by bending the thigh at a right angle to the trunk, the patient being in a recumbent position. In the case of the arm, the limb should be held up above the head.

2. *Pressure.*—If the bleeding be from a small artery, it may be arrested by applying pressure over the wound with a handkerchief, or pad of lint.

3. *Digital or Finger Compression on the Wound.*—In cases of hæmorrhage from one of the large arteries, in addition to the application of local pressure, the part is to be compressed by the fingers. This is particularly useful in small punctured or stab wounds.

4. *Digital compression against the bone* at the nearest suitable point between the wound and the heart. This is exactly similar

to the way in which a plumber stops the escape of water from a burst leaden pipe, by pressing together the two sides of the pipe above the point of escape, the only difference being that, of course, in the case of the artery, continuous pressure must be maintained to keep its walls in contact and check the flow of the blood stream. The exact methods of applying digital compression at different points will be described below in dealing with the treatment of bleeding from the special arteries.

POINTS OF COMPRESSION OF THE MAIN ARTERIES OF THE BODY.

(See Fig. 93, where the points of compression are indicated by arrows.)

(1) **Temporal Artery**—against the temporal bone, a finger's breadth in front of the opening of the ear.
(2) **Facial Artery**—against the jaw, two fingers' breadth, or 1 inch, in front of the angle of the jaw.
(3) **Carotid Artery**—against the transverse processes of the vertebræ on the side of the neck, an inch from the middle line.
(4) **Subclavian Artery**—against the first rib behind the middle of the collar-bone.
(5) **Axillary Artery**—against the head of the humerus at the junction of the anterior with the middle third of the arm-pit.
(6) **Brachial Artery**—against the humerus at the inner border of the biceps muscle, in the line of the seam of the coat-sleeve.
(7) **Radial Artery**—at the wrist, against the radius at the junction of the outer with the middle third of the forearm.
(8) **Ulnar Artery**—at the wrist, against the ulna at the junction of the inner with the middle third of the forearm.
(9) **Femoral Artery**—in the middle of the groin against the haunch bone.
(10) **Posterior Tibial Artery**—at the inner side of the ankle behind the prominence of the lower end of the tibia.
(11) **Anterior Tibial Artery**—Against the tarsus at the middle of the front of the ankle.

5. *Tourniquet Compression.*—The compression of an artery by a compressing bandage or tourniquet, applied at the nearest suitable point between the wound and the heart, should supersede as soon as possible the method of digital compression, which is naturally the method one would use first in a serious case of hæmorrhage. The tourniquet generally in use in surgical practice consists of an elastic tube or cord wound tightly round the limb, so as to compress the vessel against the bone (see Fig. 99). The elastic tourniquet is applied either next the skin or over the clothing. It is known as Esmarch's tourniquet, and the

method of its use, as applied to the thigh, is shown in Fig. 99. In military ambulance work and in surgical practice, Petit's screw tourniquet is occasionally employed. It consists of a pad to

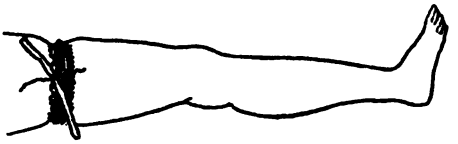


Fig. 99.—Esmarch's tourniquet on thigh.

compress the artery, with a narrow strap which encircles the limb, and is fixed by a buckle. A very powerful brass screw is attached to the strap, and by screwing down the pad (Fig. 100) the artery can be compressed with great force.

The surgical haversacks of the army medical department are supplied with field tourniquets (Fig. 101), which may be applied,

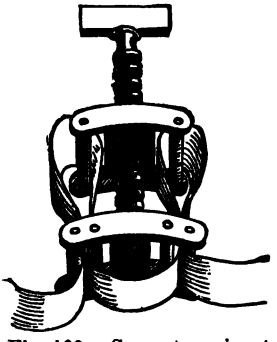


Fig. 100.—Screw tourniquet (Petit's).

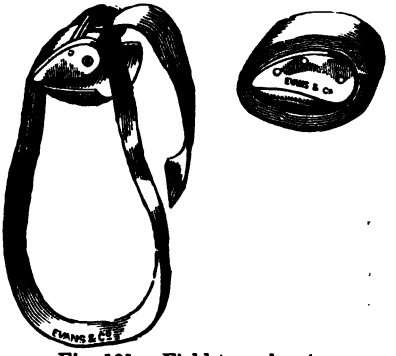


Fig. 101.—Field tourniquet.

if necessary, over the clothing, and provide a ready and reliable means of checking hæmorrhage from gunshot and other wounds. The improvised tourniquet is made from a triangular bandage, as described in Chapter II. (see Fig. 62). The knot and the tied ends of the bandage, or a special pad placed below or in the folds of the bandage, form the compressing pad, and are placed immediately over the main artery of the limb, while continuous pressure is exercised by twisting the bandage on itself by a ruler or walking-stick inserted in the loop end of the bandage. When sufficient compression has been got to entirely stop the flow of blood through the artery, the tourniquet rod is either held in position by the hand or is secured firmly to the limb by

a triangular bandage (see Fig. 62). In any case of extensive bleeding from the limbs, be it arterial or venous, while finger compression of the main artery of the limb above the wound is being made by the ambulance pupil, a tourniquet should be applied under his direction immediately above the point of digital compression, and should not be removed until it is seen that the bleeding has been checked. In making digital compression on a large artery the fingers readily tire, and have to be superseded by the continuous pressure of the elastic or improvised tourniquet. A tourniquet, however, should not be left tightly applied for an indefinite period, as prolonged pressure is apt, particularly in old and infirm people, to cause gangrene or mortification of the parts from which the blood supply is cut off by the constricting band. A safe rule is not to leave the tourniquet tightly applied for longer than an hour, after which time it should be slackened *with care* and left loose for a short time unless severe hæmorrhage recur, when the tourniquet should be immediately tightened. If the patient has to make a long railway or carriage journey under a tourniquet before medical aid can be got, an attendant thoroughly conversant with the use of the constricting bandage should in every case accompany him, and should slacken and tighten the tourniquet as may be found necessary with the precautions mentioned above.

The Methods of Arresting Hæmorrhage from the more important Arteries:—1. **Temporal Artery.**—Bleeding from the scalp or temple is to be dealt with by pressing the artery in the wound directly with the finger, or by a pad held in place by a triangular bandage (see Figs. 45 and 46). It may be arrested if the bleeding be excessive by pressing the temporal artery against the temporal bone a finger's breadth in front of the opening of the ear (see Fig. 93).

2. **Facial Artery.**—Bleeding from the face is to be arrested by digital compression of the bleeding point in the wound, assisted, if necessary, by pressing the facial artery against the bone two fingers' breadth in front of the angle of the jaw (Fig. 93).

3. **Arteries of the Lips (Coronary Arteries).**—Bleeding from the lips may be arrested by squeezing the lip firmly between the index finger and the thumb, or by compressing the facial artery.

4. **Artery of the Neck (Carotid Artery).**—Bleeding from the carotid artery or any of its branches, as in cut-throat wounds, is to be arrested by plugging the wound by a finger or thumb, or by a pad of lint or a handkerchief, while compression is kept up on the carotid artery against the spine. This is done by pressing

with the thumb in the line already mentioned, on the artery just in front of the large muscle of the side of the neck, while the fingers lie behind the neck (Fig. 93). The right hand would then be used in compressing the patient's left carotid artery, the left in compressing the right carotid artery. Pressure, of course, has to be made between the bleeding point and the heart.

5. **Artery of the Arm-Pit (Axillary Artery).**—Bleeding from the artery in the arm-pit may be arrested in either of two ways :—

(*a*) By placing a firm pad in the arm-pit, and binding the arm firmly to the body ; and

(*b*) Where the first method fails to entirely stop the bleeding, it may be arrested by compressing the subclavian artery against the first rib by the thumb, which is pressed down on the artery behind the middle of the collar bone. The exact method of compressing the subclavian artery is shown in Fig. 102.

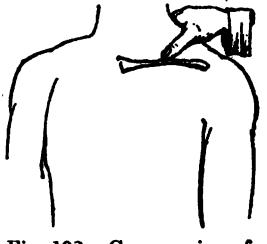


Fig. 102.—Compression of subclavian artery by thumb.

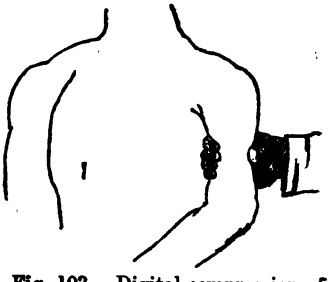


Fig. 103.—Digital compression of brachial artery.

6. **Artery of the Arm (Brachial Artery).**—Bleeding from the artery of the arm is to be arrested by (*a*) digital compression of the artery against the humerus just internal to the biceps muscle, and between the wound and the heart. The artery is said to run in the line of the seam of the coat-sleeve. The fingers passed behind the arm lie immediately over the artery, as shown in Fig. 103, while a great power of compression is got by grasping the arm with the thumb on its outer aspect ; or (*b*) by a tourniquet applied in the same situation. A pad and firm bandage should, in addition, be applied over the wound.

7. **Bleeding from the front of the elbow** is to be arrested by (*a*) placing a pad in the bend of the elbow and binding the forearm to the arm with a triangular bandage ; or (*b*) by compressing the brachial artery by the fingers or a tourniquet.

8. **Arteries of the Forearm (Radial and Ulnar).**—Bleeding from either of these arteries is best arrested by digital or tourniquet compression of the brachial artery. It may also be accomplished by placing a pad in front of the elbow joint, and bandaging the forearm firmly to the arm as shown in Fig. 104. Sufficient pressure is thus brought to bear on the brachial artery at the elbow.

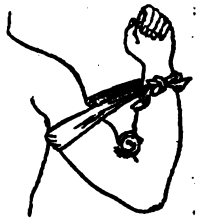


Fig. 104.—Bleeding from forearm checked by pad and flexion.

9. **Bleeding from the Hand (Palmar Arch).**—Bleeding from the hand is best arrested (*a*) by pads placed over the radial and ulnar arteries at the wrist, and firmly fixed with a triangular bandage; or (*b*) by a tourniquet tightly applied round the lower part of the forearm. Bleeding from the palm may also be arrested by making the patient grasp a pad placed in the palm while the fingers are tightly bandaged over it.

10. **Artery of the Thigh (Femoral Artery).**—Bleeding from the femoral artery is to be arrested by (*a*) digital compression in the groin by two thumbs, one backing the other, as shown in Fig. 105; or (*b*) by a tourniquet (with or without a

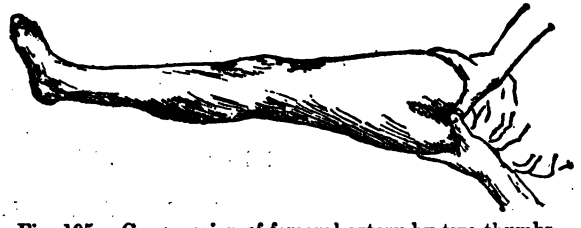


Fig. 105.—Compression of femoral artery by two thumbs.

pad below it) applied between the wound and the heart. When bleeding occurs high up in the thigh a tourniquet applied above the wound will tend to slip downwards, and digital compression is then the only means to be relied on.

11. **Artery at the back of the Knee-Joint (Popliteal Artery).**—Bleeding from this artery may be checked by (*a*) placing a firm pad at the back of the knee-joint, and binding the leg firmly to the thigh, and fixing it with a triangular bandage; or (*b*) by digital or tourniquet compression of the femoral artery.

12. **Arteries of the Leg (Anterior and Posterior Tibial and Peroneal).**—Bleeding from any of the large arteries of the

leg is best arrested by digital or tourniquet compression of the femoral artery. An alternative plan is to place a large pad in the space behind the knee-joint and to bandage the leg firmly to the thigh (compare Fig. 104).

13. **From the Sole of the Foot.**—Bleeding from the sole arteries may be arrested by (*a*) a small pad placed just behind the tibia at the inner ankle, and firmly fixed by a triangular bandage; or (*b*) by digital or tourniquet compression of the femoral artery.

Vomiting and Spitting of Blood.—Though bleeding from the lungs—spitting of blood or hæmoptysis—and bleeding from the stomach—vomiting of blood or hæmatemesis—are not usually included in a description of "first aid" in hæmorrhage, it is expedient that the ambulance pupil should be familiar with the following points:—In such cases a medical man should be sent for *at once* with a message as to the exact condition from which the patient is suffering. The patient should then be put into bed in a darkened room, and kept very quiet until the arrival of the doctor. If ice can be procured, the patient should be allowed a little of it to suck. On no account should stimulants be given. In ordinary cases internal styptics as gallic and tannic acids, steel drops, turpentine, &c., are employed, and may be got ready for use, but should not be administered without the sanction of the medical attendant. In these cases an important part of the "first aid" treatment is to keep cool, to avoid exciting the patient who is already in a very nervous condition, and to have ready for the medical attendant whichever of the above styptics can be procured. The vomited or expectorated blood should not be thrown away, but should be kept for the doctor's inspection.

Bleeding from the Nose.—Bleeding from the nose is often very troublesome. It may be arrested by placing pads of lint soaked in cold or iced water over the root of the nose, or by applying wet compresses or ice bags to the upper part of the neck. If this is not sufficient a firm plug should be placed in each nostril, the patient being kept seated in a chair. A firm plug of lint is very serviceable, or as a substitute a handkerchief may be used, the middle of which is passed into the nose for about an inch by the blunt end of a pencil. Into the pouch of handkerchief so formed cotton wadding is tightly packed with the pencil end. A medical man should be summoned at once, as it is very often necessary to plug the posterior openings of the nose from which the blood is apt to escape down into the back of the throat in spite of firm plugging applied in front. In mild cases plugging the nostrils in

front with lint soaked in a solution of alum is generally sufficient to arrest the bleeding.

Bleeding from the Socket of a Tooth.—After the extraction of a tooth it occasionally happens that the bleeding, which is, as a rule, easily stopped by washing out the mouth with warm water, may recur sometime after the patient has left the dentist's operating room. The amount of blood that may be lost in such a case is often very considerable, and it is well that the ambulance student should have some idea of how to check it. In cases where the assistance of the dentist or a medical man cannot be got, it is best treated by washing out the mouth with very warm water and by packing securely into the socket of the extracted tooth with a pencil or wooden penholder small pledgets of cotton wadding which have been previously rubbed in dried alum powder. If difficulty is experienced in getting the plug to remain in position, it may be overcome by making the patient keep the mouth firmly closed, the teeth of the opposing jaw then serving to keep the plug in position.

Bleeding from Hæmorrhoids.—Patients suffering from large internal hæmorrhoids or piles may occasionally, when the bowels are constipated, lose a considerable amount of venous blood. Where the escape is considerable it may, till the arrival of a medical man, be treated by washing the parts with very warm water, and by applying on a piece of lint a little of the gall and opium ointment which patients suffering from this condition generally have at hand.

Bleeding from the Ears.—Bleeding from the ears is generally a symptom of fracture of the base of the skull. Medical aid should be summoned at once, and the patient kept in a recumbent position with the head raised till the arrival of the surgeon.

Blood in the Urine.—Blood in the urine is generally a sign of disease of the bladder or kidney—*e.g.*, Bright's disease, stone in the bladder, &c.—and is generally a serious condition, requiring immediate surgical treatment.

Hæmophilia.—Certain individuals, happily few in number, inherit a tendency to bleed owing to a deficient power of coagulation in the blood. In these people the slightest touch or knock is apt to be followed by a bruise, and if the patient have even a small artery or vein cut the amount of blood lost may be very considerable indeed, owing to this deficient power of coagulation. A person with this inherited tendency to lose blood is known as a "bleeder," and the condition is called hæmophilia. The condition is fortunately rare, but will explain to the ambulance

student those cases which are occasionally met with, where the bleeding from a small cut may be so considerable as even to endanger life, and may require energetic surgical treatment before it can be arrested.

Internal Hæmorrhage.—If a large vessel in the chest or abdomen be cut by a stab wound or burst from internal disease, a large amount of blood may escape into the thoracic or abdominal cavity, while little or none may come to the exterior of the body. The condition can generally be inferred from the appearance of the external wound if the bleeding be due to injury, or from the personal history of the patient if due to disease. The pallor, coldness, and faintness of the patient are all indicative of a serious loss of blood. It is essential that medical aid should be at once summoned. The patient should be laid in bed, or on a sofa, in a darkened room, with the head low, and the treatment described below for collapse from hæmorrhage should be carried out, save that no stimulant of any form should be given without the sanction of a medical man.

Collapse from Hæmorrhage.—When a patient becomes collapsed from the loss of blood, the condition is easily recognised by the faintness and dizziness complained of, by the feeble nature of the pulse, by general pallor, seen particularly in the face, and by the coldness of the body, and especially of the extremities. The condition may be so pronounced as to produce swooning and insensibility of the patient, and the condition is then known as syncope.

Treatment.—The patient should be laid at once between warm blankets, with the head low. Warm bottles should be packed round him. Alcoholic and diffusible stimulants, like tea and coffee, should be given freely if the patient can swallow, *but only if the hæmorrhage has been satisfactorily arrested, and there is no probability of its re-appearance on reaction setting in.*

CHAPTER VII.

WOUNDS.

SHOCK—VARIETIES OF WOUNDS, INCISED, CONTUSED, PUNCTURED, LACERATED — CHARACTERISTICS AND TREATMENT — THE ANTISEPTIC TREATMENT OF WOUNDS—ANTISEPTIC METHODS—EMERGENCY ANTISEPTICS—ANTISEPTIC TREATMENT IN AMBULANCE CASES—POISONED WOUNDS—THE TRUE POISONED WOUND—STINGS—SNAKE BITES—HORSE BITES—DOG BITES—CAT BITES—TREATMENT.

WOUNDS vary in degree from a mere abrasion of the cuticle or rubbing off of the superficial layer of the skin to severe conditions, when the whole of the structures of a limb may be rent asunder—*e.g.*, in some cases of machinery accident where, if the limb be not pulled entirely off, the muscles, sinews, and bones are torn across, and the upper part of the limb is kept in connection with the lower only by the elastic skin and the tissue immediately underlying it. In cases of severe wounds, particularly in nervous people, a condition is apt to supervene which is known as *shock*. Shock is the name given to a condition where the vitality of a patient is greatly lowered, owing to a sudden and violent impression on some part of his nervous system produced by an injury. This nervous impression acts first upon the heart and may in extreme cases cause death by arrest of the heart's action. Shock also, however, manifests itself by its action on the other organs, and on the tissues generally. Where shock is well marked, the following are some of the prominent signs:—The patient looks collapsed, is helpless, and is unable to move. There is marked pallor of the surface of the body, and particularly of the face. The temperature of the body is much lowered, the patient feels cold, and may shiver. The respiration is feeble and gasping. The pulse is small and irregular, and may even be imperceptible.

Such a condition is apt to be brought about by any serious accident—*e.g.*, a compound fracture, a gun-shot or lacerated wound, or a severe burn.

Treatment of Shock.—The treatment of shock consists in bringing about reaction by the application of heat and the administration of stimulants. This is attained by stimulating the patient, first by ordinary stimulants, as whisky or brandy,

and next by warm diffusible stimulants like tea and coffee. Teaspoonful doses of sal-volatile in water are also very useful. The room should be kept warm. The patient should be placed in bed between blankets, and warm bottles should be freely applied. His head should be kept low.

Wounds may for purposes of description be divided into the following four classes :—

1. Incised or clean cut wounds.
2. Contused or bruised wounds.
3. Punctured or stab wounds.
4. Lacerated or torn wounds.

1. **Incised or Clean Cut Wounds.**—Incised or clean cut wounds are produced by a knife or other sharp cutting instrument, and have cleanly divided edges. The fibres of the tissues involved are cut directly across, and therefore the wound gapes (Fig. 106),

Fig. 106. Incised wound.

Fig. 107.—Wound, closed by two strips of plaster.

Fig. 108.—Method of cutting strips of plaster.

and in addition tends to bleed considerably, as the vessels have undergone a similar division. An incised wound if clean generally heals in a few days by "first intention," skin uniting to skin and the other structures in the depth similarly.

Treatment.—After the bleeding has been arrested in the usual way, the wound should be washed and dressed. If the wound gape, the edges may be brought together by strips of adhesive plaster, and best in the method shown in Figs. 107 and 108. To seal the edges of a wound that is not gaping much, Friar's balsam or collodion is sometimes applied. An emergency dressing for an incised wound may be extemporised from a piece of linen soaked in carbolic oil, turpentine, or whisky, covered with cotton wool, and fixed by a triangular bandage in the "cravat" form.

A special form of incised wound is the **cut-throat wound**, which, from the tenseness of the structures in front of the neck, usually gapes considerably. There is generally a considerable amount of hæmorrhage from cut veins (external and anterior jugular veins), and, not uncommonly, the windpipe is cut across,

the patient then breathing through the wound in the neck, the whizz of the outrushing air being distinctly heard. In some cases the large artery of the neck (carotid artery) is divided, and the patient may succumb from hæmorrhage before help arrives. The treatment of ordinary cases of cut-throat consists in preventing the patient from doing himself further harm, and to attain this, force may often have to be used. The bleeding, if venous, must be arrested by pressure on the bleeding points in the best way possible. If the windpipe be cut, blood should, as far as possible, be prevented from entering the lungs. Medical aid should be summoned at once, and the patient should on no account be left alone till the arrival of the doctor. If the carotid artery or any of its main branches be cut, pressure should be made on the carotid artery low down in the neck against the transverse processes of the vertebræ on which it lies. This is best done by the thumb, which is pressed deep into the tissues of the neck half an inch to the outside of the windpipe. The opening in the neck through which the patient is breathing should not be closed by a plug or otherwise, but the blood from the edges of the wound should be mopped up and not allowed to trickle into the windpipe.*

2. **Contused or Bruised Wounds.**—Contused or bruised wounds are generally produced by blows from a heavy body—*e.g.*, a policeman's baton, or by sudden and severe pressure, as in the case of a horse bite inflicted through the clothes.

The characteristics of such a wound are pain and swelling, with some amount of bruising or ecchymosis. The bruising is due to the extravasation of blood. The blood is of a dark venous colour, but after a day or two the bluish-black colour begins to fade from the absorption of the blood pigments, usually beginning at the border of the bruise, and gradually passes through different shades of colour—green, yellow, and lemon—back to the normal.

Treatment.—This consists in applying pressure to prevent further swelling by a pad of cotton wadding or linen fixed by a triangular "narrow cloth" bandage, or, better, by a firmly applied "figure-of-eight" roller bandage.

To diminish the swelling and amount of extravasation either tincture of arnica or hazeline may be rubbed gently into the part or applied on compresses of lint to it.

A special form of contused wound is the **gun-shot wound.** This, if produced by a bullet, will usually show an "entrance wound," small, and with inverted edges, while the "wound of exit" will be larger, and have torn and lacerated edges. If

* The bleeding is, as a rule, easily arrested by pressure.

produced by a shot-gun fired close to the body, there will usually be considerable bruising, and a tunnel wound leading into the depth.

No gun-shot wound should be interfered with, save for the application of a disinfectant dressing. No attempt should be made to remove the bullet, even though its position be known. The part should be very carefully handled, as it is not uncommon for the bone to be splintered or fractured. Hæmorrhage is to be treated in the usual way. In the case of hæmorrhage from a gun-shot wound of the chest, the wound should be plugged with an antiseptic plug. A patient with a gun-shot wound usually suffers from the condition known as "shock," already described, and has to be treated accordingly.

3. **Punctured** or **Stab Wounds.**—Punctured or stab wounds differ in degree according to the depth of the puncture and the nature of the weapon producing it. When caused by a needle or small knife-blade, such wounds readily heal, but if produced by teeth or by stabbing with a dagger or bayonet they are much more serious, for three reasons—(*a*) owing to the number and importance of the structures cut; (*b*) the increased risk of severe hæmorrhage; and (*c*) the chance of the decomposition of blood and of other tissues in the depth of a wound imperfectly drained.

Treatment.—Hæmorrhage is to be treated in the usual way. The wound should be carefully washed with some disinfectant solution, and a dressing applied. If the pain be very great a poultice may be applied.

4. **Lacerated** or **Torn Wounds.**—Lacerated or torn wounds are very common in machinery accidents, are characterised by the lacerated and torn condition of the part, and are accompanied by little or no bleeding, owing to the pulling out of the coats of the vessels. They are commonly found on the hand, in wounds produced by circular or cross-cut saws, and in severe cases the whole limb may be so much torn and pulped by heavy rollers, forked teeth, or cog-wheels of machinery that it is impossible to save the part, and the limb must be amputated. Lacerated wounds are easily recognised by the appearance of the part. They are characterised by little pain, and by only slight hæmorrhage. In severe cases the tearing of the vessels may be so great that no hæmorrhage takes place at all. Indeed the arm may be torn off and only a few drops of blood lost. Lacerated wounds generally heal by "second intention" or ulceration, an ulcer being formed and the skin growing inwards from the edges. This process takes some weeks,

and is generally attended with a fair amount of discharge from the wound of the nature of pus or matter.

Treatment.—A lacerated wound should be carefully washed and dressed, and the part rested.

Antiseptic Treatment of Wounds.—In olden days wounds were either left open to the air or very imperfectly dressed, with the result that putrefaction generally set in, pus or matter being formed, and that the wound did not heal. By very careful examination and experiment it was found that the cause of this putrefaction in wounds lay in the air, and that if the air were excluded from the wound much better results in healing were obtained. This putrefaction in a wound is known as sepsis, and a putrefying wound is known technically as a septic one. The antiseptic treatment of wounds has as its essential characteristic the management of wounds in such a way as to prevent this septicity or putrefaction taking place. The air itself is, however, not the cause of the mischief. In the air float minute particles, which, when examined, are found to be living organisms capable of multiplying. These organisms are known as **germs.** By their multiplication and growth in a wound they produce fermentation, just as yeast cells growing and multiplying produce fermentation in a sugary liquid; and the result of the fermentation so produced is the formation of putrefactive or poisonous matters, which gain access to the blood and cause the condition known as blood-poisoning. Sir Joseph Lister was the first to show the importance of these organisms in relation to the treatment of wounds, and since his great discovery much light has been thrown on the subject by microscopic investigation and experimental research. A large number of organisms have now been isolated and proved to be the cause of special diseases—*e.g.*, erysipelas, cholera, diphtheria, &c.

The antiseptic treatment of wounds has, since its original introduction, undergone at the hands of Sir Joseph Lister and others considerable change. It is now known that the special germs which cause such fatal infective wound disorders as blood-poisoning, erysipelas, &c., can be readily killed (even if present in large numbers in a wound) by special substances, which are known as **antiseptics.** The antiseptic first recommended, and the one that has held its own ever since its introduction, is carbolic acid. It is *the* antiseptic that will be found most serviceable for ambulance work, for a foul wound can be rendered quite pure by washing with strong carbolic acid solution. A solution of 1 part of carbolic acid in 40 parts of water, which is a safe strength for the ambulance pupil to

employ, can be readily made by mixing half a wine glassful of liquid carbolic acid with a pint of water. It is advisable not only to wash the surface and depth of the wound with carbolic water, but also to thoroughly disinfect the skin for some distance round the wound with the antiseptic solution. Carbolic acid, if used in strong solution and in large quantity, is absorbed into the blood and produces a poisonous effect. Other acids, such as

Fig. 108*a*.—Milne's ambulance stock box.

boric and salicylic, have been used for the same purpose, and though less powerful are also less poisonous. Another most powerful and reliable antiseptic is mercury in the form of

corrosive sublimate, which may be used for emergency purposes in the form of a solution of 1 part of the sublimate in 2,000 parts of water. The best method of using corrosive sublimate is in the form of the soloids or small compressed tablets of this substance as prepared by Messrs. Burroughs, Wellcome & Company, Snowhill Buildings, London. One of these soloids dissolved in a pint of water gives a solution of the strength of 1 in 1,000. For large manufactories in which accidents are common, or for the purpose of taking abroad, no more reliable or more portable form of antiseptic store can be found than a small bottle of Messrs. Burroughs, Wellcome & Co.'s corrosive soloids.

For hospitals, railway depôts, ambulance waggons, surgeries, police stations, and other places where attention to accidents is frequently required, Mr. John Milne, of the Antiseptic Dressing Factory, Ladywell, London, has prepared an ambulance stock box (Fig. 108*a*), containing a variety of dressings of antiseptic gauze, with wool, lint, plaster, sponges, catgut sutures, and all necessaries for the immediate treatment of accident cases. It is made in three sizes, sufficient for the dressing of 300, 100, and 30 cases respectively. The small size costs only £5.*

Emergency Antiseptics.—For ambulance purposes, where carbolic acid and corrosive sublimate may not readily be procurable, some of the following emergency antiseptics may be employed:—

1. *Alcohol.*—This may be used in the form of whisky with an equal bulk of water; or in the form of methylated spirits similarly diluted.

2. *Turpentine.*—This is a most reliable antiseptic, and with it the surface of a wound may be washed. It is particularly useful for disinfecting the skin round a wound.

3. *Acetic acid* in the form of vinegar may be used either pure or diluted with an equal bulk of warm water.

4. *Condy's fluid* (a solution of permanganate of potash) may be used to the strength of two table-spoonfuls to a pint of warm water; that is, in sufficient quantity to make the water of a deep blue colour. Crystals of permanganate of potash may be used instead of Condy's fluid. The permanganate salt may also be had in a very handy form in the shape of pellets, similar to Messrs. Burroughs, Wellcome & Co.'s mercuric soloids.

5. *Common salt* may be used as a solution, a dessert-spoonful of salt being added to a tumbler of warm water.

Antiseptic Treatment in Ambulance Cases.—It is of great importance that the ambulance student approach the treatment, not only of severe injuries like compound fractures,

* The St. John Ambulance Association also supplies, at a very reasonable rate, "First Aid" Chests and Ambulance Hampers containing all requisites.

but also of small and seemingly unimportant wounds, with a due sense of the danger to the patient, which may be caused by

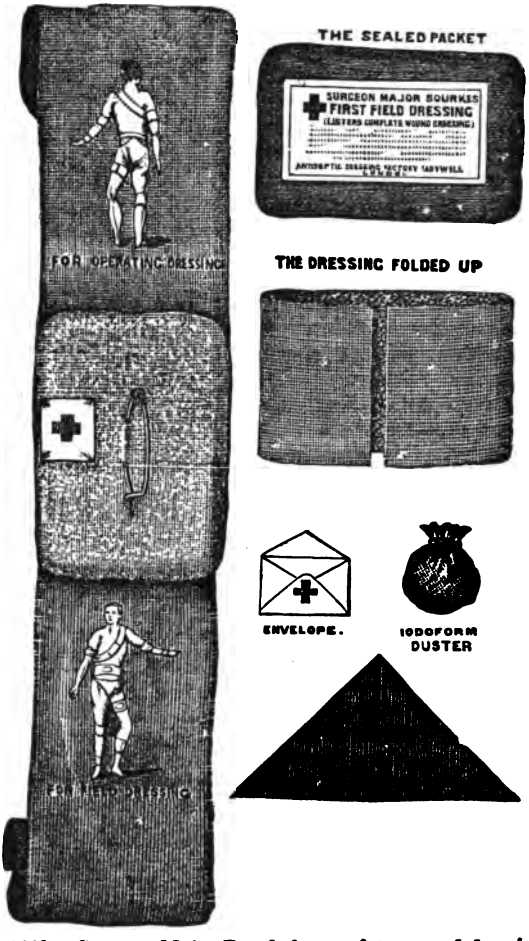


Fig. 108*b*.—Surgeon-Major Bourke's complete wound dressing.

insufficient care during the first-aid treatment of the injury. It should be remembered that even such a small thing as the prick of a dirty needle may in a debilitated patient cause, if

neglected, a large abscess, and subsequent blood-poisoning. No boil or blister, however innocent looking, should be punctured with an unclean needle or pin, as this is too often the starting point of severe wounds. One should not be content with simply washing the wound with a disinfectant. One must also see that one's hands are clean before applying lotion to a wound, and also that suitable precautions are taken by proper dressings to prevent the entrance of organisms to a wound which has so far been rendered pure by antiseptic washing. The trained ambulance pupil should, if possible, and it will be so in a certain proportion of wound cases, wash his hands well with warm water and soap, and rub them with turpentine, or rinse them in a carbolic solution (1 to 40) before attending to the wound. He should then select, for applying the lotion, a piece of clean absorbent or cotton wool, or a clean handkerchief. An absolutely new sponge may also be used with safety, but *a sponge that has been in use for household purposes should on no account be employed to wash the wound.* The wound being thoroughly washed with the best antiseptic at hand, a pledget of cotton wool, soaked in a disinfectant solution, should then be left over the wound until a suitable dressing can be prepared. Suitable emergency antiseptic dressings may be made from boric lint, or ordinary lint soaked in a 1 to 40 solution of carbolic acid, and applied over and fixed to the wound by a triangular bandage. Masses of cotton wadding soaked in the solution may be applied over the lint, or directly to the wound if no lint be procurable. In place of cotton wadding, clean handkerchiefs similarly soaked may be used. Lint soaked with carbolic oil is a good emergency dressing. Carbolised tow is also of great service in a case of street accident. In a large town most of the dressings mentioned above may be procured at very short notice, and can readily be applied if the patient be taken for first-aid treatment, as frequently happens, to a chemist's shop. In the country, or where none of the above dressings can be readily got, a clean handkerchief, piece of linen, or mass of cotton wool, soaked in whisky or turpentine, will serve admirably as an antiseptic dressing, and may be relied on to serve its purpose till the patient can be seen and properly attended to by a medical man.

Reference must here be made to a complete wound dressing (Fig. 108*b*) proposed by Surgeon-Major Bourke, A.M.S. It is a first dressing, which is simple, light, and complete in its requirements, and can be used, not only in surgical practice, but also with equal success in first aid cases. It consists of layers of Alembroth wool enclosed in Alembroth gauze, forming a pad

5 inches long and 3½ inches wide. To this an Alembroth bandage about 1½ yards long is attached about its centre, and forms with the gauzed wool a pocket, in which is placed a small bag of iodoform. A safety-pin completes the dressing. The whole is enclosed in air-proof parchment, with directions as to use. It is prepared for use on the battlefield, but is of great service, and should be at hand, at railway depôts, surgeries, police stations, collieries, iron foundries, &c.

POISONED WOUNDS.—Poisoned wounds will be best dealt with under the following subdivisions:—

1. The true poisoned wound.
2. Stings.
3. Snake bites.
4. Horse bites.
5. Dog bites and cat bites.

1. The **true poisoned wound**, as exemplified by a wound received at a *post-mortem* examination or by a puncture with a dirty needle, is characterised by the formation of matter in the part, owing to the local irritation of the poison, and by a tendency for the products of decomposition to be absorbed into the system and to cause blood-poisoning. Round such a wound there is great inflammation, reddening of the skin, and swelling. The part is very tender, and causes great uneasiness to the patient. From absorption from the wound the patient is greatly fevered (see Fig. 159, p. 183). Such a wound, as a rule, tends to suppurate or form matter. A very common form of the poisoned wound is a whitlow, where matter is formed in and around the tendon-sheath of a finger or thumb. The lymphatics absorb the poison and become inflamed and sore; the lymphatic glands enlarge and become tender, and frequently an abscess forms in the arm-pit. In addition to the risk of blood-poisoning there is also the chance of erysipelas or other wound disorder attacking the already greatly weakened patient. Erysipelas or "the rose" is a very infectious and dangerous form of wound disorder, and requires isolation of the patient and strict antiseptic treatment of the wound.

Treatment.—Such wounds should be prevented, if possible, by washing at the time of infliction with a strong disinfectant, as described under the antiseptic treatment of wounds. A poisoned wound if actually in progress should be attended to at once, drained of its matter, thoroughly disinfected, antiseptically dressed, and poisoning arrested. It is the greatest possible mistake even for a trained ambulance pupil to attempt treat-

ment of these collections of matter by continued poulticing or by puncturing the part with a needle or pin to "let it out." It should be attended to at once by a medical man. If any foreign body, as a piece of glass, or part of a broken needle, be left in the wound, it should be removed as soon as possible.

2. **Stings.**—A sting from a bee or a wasp is treated by removing the sting if it can be seen, by washing the wound with a disinfectant solution and applying a small dressing. The affected part should be rested as far as possible. Where the stinging has taken place over a large surface, and particularly in a small child, stimulants should be given, as shock is likely to supervene.

3. **Snake Bites.**—In snake bites, as in every poisoned bite, the indications for treatment are twofold:—(1) The prevention of the poison from entering the system generally, and (2) the destruction of the poison already in the wound, and, if necessary, of the parts affected by it. The poison is prevented from entering the system by a ligature or tourniquet applied tightly round the limb between the wound and the heart. The constricting band so applied should not be loosened till all risk of absorption of the poison is past, the same precautions, however, being observed in the use of the tourniquet as were mentioned under hæmorrhage, viz., that the tourniquet should not be left on indefinitely, from the risk of mortification owing to the blood supply being cut off, but should be every now and then slackened for a minute or two and then re-applied. The poison in the wound should then be destroyed by washing the part *thoroughly* with a strong antiseptic solution, or, failing that, with one of the emergency disinfectants detailed above—*e.g.*, whisky, turpentine, or strong carbolic acid solution. The wound may, if necessary, be freely scarified with a knife so as to allow the escape of the poisoned blood pent up in the part by the ligature. The wound may also be cauterised in a severe case with a red-hot iron or with nitrate of silver (lunar caustic), if it be at hand. The poison may very efficaciously be removed by sucking the wound, and this may be done with perfect safety if the operator has no cracks about the lips or tongue, through which absorption might take place. In the case of bites about the chest, neck, or face, where no tourniquet can be applied, sucking, disinfection, and cauterisation are the only means at disposal. In cases of snake bite large doses either of alcohol in the form of whisky or brandy, or of ammonia in the form of sal volatile (a teaspoonful in water frequently repeated) are advised. Medical aid should be procured as soon as possible.

4. **Horse Bites.**—Horse bites, which are inflicted through

the clothes in most cases, are simply contused wounds, and are to be treated as such, but where the skin is torn or the tissues lacerated, the wound should be carefully disinfected and dressed, and the part rested.

5. **Dog Bites.**—Dog bites are to be treated on the same principle as snake bites, and with as great care, lest the animal may have been rabid. It should be remembered that a rabid dog—*i.e.*, one suffering from "rabies" or "rage"—has in his saliva a poison, which, entering the wound at the time of its infliction, tends, after a variable time, to produce in man the disease known as hydrophobia or "fear of water," so called from one of its constant and prominent symptoms. A dog suspected to be rabid should not be destroyed immediately after the accident, but should be chained up and watched, so that it may be ascertained whether it be actually suffering from this disease. Though it is not so common, still it is the case that rabies attacks cats, and that hydrophobia may follow a cat bite. It is well that the ambulance pupil should know the signs by which a rabid dog may be recognised. These will best be gathered from Mr. Youatt's description of the condition in his work on *Canine Madness*. His description is as follows:—

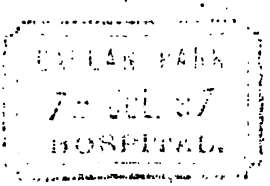
"The disease manifests itself under two forms:—The *furious* form, characterised by augmented activity of the sensorial and locomotive systems, a disposition to bite, and a continued peculiar bark. The animal becomes altered in habits and disposition, has an inclination to lick or carry inedible substances, is restless, and snaps in the air, but is still obedient and attached. Soon there are loss of appetite and the presence of thirst, the mouth and tongue swollen; the eyes red, dull, and half closed; the skin of the forehead wrinkled; the coat rough and staring; the gait unsteady and staggering; there is a periodic disposition to bite, the animal in approaching is often quiet and friendly, and then snaps; latterly, there is paralysis of the extremities; the breathing and deglutition become affected by spasms; the external surface irritable, and the sensorial functions increased in activity and perverted; convulsions may occur. These symptoms are paroxysmal, they remit and intermit, and are often excited by sight, hearing, or touch.

"The *sullen* form is characterised by shyness and depression, in which there is no disposition to bite and no fear of fluids. The dog appears to be unusually quiet, is melancholy, and has depression of spirits; although he has no fear of water, he does not drink; makes no attempt to bite, and seems haggard and suspicious, avoiding society and refusing food. The breathing is

laboured, and the bark is harsh, rough, and altered in tone; the mouth is open from the dropping of the jaw; the tongue protrudes, and the saliva is constantly flowing. The breathing soon becomes more difficult and laborious; there are tremors and vomiting and convulsions."

As in the case of snake bite, there is much less risk to the patient if the bite has been inflicted through his clothing, as the poison may be partially or wholly removed from the fang of the tooth by the clothing. Bites on exposed parts, and particularly on the face, are for this reason most liable to be followed by rabies.

A patient bitten by a dog known to be rabid is to be treated exactly on the same lines and with as great care as one bitten by a venomous snake. If the dog is not absolutely known, but is suspected, to be rabid, the treatment should be as careful as in the first case. Where, however, the dog is known to be quite free of rabies, all that is required is the disinfection of the wound. The first thing to do in every case is, of course, to apply a tourniquet. The wound should then be thoroughly washed with an antiseptic solution, preferably Condy's fluid. The subsequent treatment is exactly similar to that of snake bite. It is a popular but utterly unfounded belief that if a non-rabid dog bite a person, that person will afterwards develop hydrophobia if the dog itself at any subsequent time become rabid. The destruction of the dog, if compassed only to prevent such an impossible contingency, is quite unwarrantable.



CHAPTER VIII.

INSENSIBILITY AND FITS.

FAINTING—HYSTERIA—APOPLEXY—ALCOHOLIC INTOXICATION—EPILEPSY—CONVULSIONS AND UNCONSCIOUSNESS DUE TO KIDNEY DISEASE—CONCUSSION AND COMPRESSION OF THE BRAIN—SHOCK AND COLLAPSE—SUFFOCATION.

WHEN a person is found lying unconscious, either in the open air or in a public room or bedroom, it is the duty of an ambulance pupil to find out the cause of the unconsciousness, and to render the appropriate first aid.

To do this successfully and with confidence, the student must be aware of the conditions which cause insensibility, of the points of difference in their symptoms, and of the immediate treatment. The patient, being insensible, can of course give no information as to the cause or nature of his attack, and so the ambulance pupil is absolutely dependent on his own observations of the surroundings and conditions of the patient, and on any information he may be able to obtain from bystanders or friends, for the facts by which he may recognise the special cause of insensibility. Insensibility may be either partial or complete. It is due to the brain being deprived of its natural supply of blood by hæmorrhage or otherwise, to the brain being compressed by injury or the bursting of a blood-vessel inside the skull, or to the action of certain narcotic drugs upon the nervous system. Each of these conditions can be recognised partly from the history of the case, but mainly from the symptoms present. Insensibility is sometimes simulated by beggars and others. These malingerers or pretenders can generally be detected if a careful examination be made. One of the best tests of insensibility is to touch the clear part of the eye with the tip of the finger. This is borne by the insensible patient without any movement of the eyelids or evidence of pain. No malingerer will stand this, but will immediately show signs of consciousness by closing the eyelids or turning away the head on this test being applied. Most of these cases of pretended insensibility can be cured either by giving a stimulant (which is what the patient wants, and which should not be given) or, what is far better, by fairly rough treatment.

The conditions which give rise to insensibility will best be taken up in the following order :—

I. Fainting (syncope).
II. Hysteria—Hysterical fit.
III. Apoplexy.
IV. Alcoholic intoxication.
V. Epilepsy, or falling sickness.
VI. Opium poisoning.
VII. Convulsions and unconsciousness due to kidney disease.
VIII. Concussion and compression of the brain.
IX. Shock and collapse.
X. Suffocation.

I. **Fainting (Syncope).**—Syncope, fainting, or swooning is due to failure of the heart's action, and to an imperfect supply of pure blood to the brain. Excessive hæmorrhage is a frequent cause of this. It is often due to some disturbing cause, a nasty smell, disgusting sight, and sometimes to the sight of blood. The patient feels giddy and sick, and becomes unconscious for a short time. The face is pale, the pulse imperceptible. Gradually the circulation is restored, and the pulse, colour, and consciousness return.

Treatment.—The principles of treatment are (1) to keep the head low, so as to allow the return of blood to the brain; and (2) to stimulate the patient, and improve the circulation.

The patient should accordingly be placed with the head on the same level as the rest of the body, all tight clothing about the body and neck should be loosened, and cold water should be sprinkled on the face. Smelling salts (ammonia) or burnt feathers may be held before the nose. As soon as the patient is able to swallow, she (for it is generally a lady that requires ambulance treatment for this condition) should have a glass of water, or a little whisky, brandy, or sal volatile. She should be allowed to lie for some time with the head low, until all feeling of faintness has passed off. If the fainting take place in a crowded lecture-room or church, it may be sufficient to make the patient incline the head till it is on a level with the knees. If this is not at once successful, the patient should be gently led or carried out into the open air.

II. **Hysteria—Hysterical Fit.**—Hysteria is the name given to a morbid mental condition, of which one of the chief signs is the so-called "hysterical fit" or "the vapours."

The patient—generally a nervous young woman—begins to cry and sob without any apparent cause, or to laugh and cry alternately, and in slight cases the "hysterics" may go no

further than this. In severe cases there may be slight convulsive attacks, and the patient may appear to be unconscious. The breathing is quickened, the eyelids are closed, the eyelids quiver, but the patient, if closely watched, will be seen to take notice of what is going on around. The hysterical patient, in severe attacks, falls down apparently unconscious, but unlike the epileptic *never hurts herself.* It should be stated that hysteria is not a mere simulation of disease, but that there is really at the bottom of it a diseased or disordered condition of the patient's nervous system. It is stated above that hysteria generally occurs in nervous and delicate young women, but it is worthy of mention that a similar condition is found in males, and that it is not unknown in boys, and has been found in debilitated and overworked men of middle age. In males the condition is known as hypochondriasis.

Treatment.—The condition is a nervous one, in which the woman has a profound craving for sympathy. She is not, perhaps, in good health, but she wishes to make the most of her ailment, and to get people to notice it. There will generally be found in the room in such cases a number of sympathising lady friends, who should be dismissed after the nature of the fit has been told them. The patient should then be treated firmly, and should be led to understand that her true condition is recognised. No sympathy should be extended to her. The more sympathy and attention that the patient gets the longer and more severe will the fit be. A little cold water may be thrown on the face, after which the ambulance pupil may leave the room, slamming the door, and letting the patient understand that no further attention will be paid to her. She will speedily recover, but may lapse into another fit if too much notice be taken.

III. **Apoplexy.**—A patient who is suffering from apoplexy or "apoplectic fit," or who, in popular language, has had "a shock of paralysis," is rendered unconscious by a disturbance of the circulation within the brain cavity, by the plugging or the "bursting" of a blood-vessel, either on the surface or in the substance of the brain.

Symptoms.—The signs by which an apoplectic seizure may be recognised are the following:—

The face is usually flushed, the breathing is deep, slow, and stertorous, and the face and the whole surface of the body may perspire freely. The patient, who is generally an elderly person, cannot be roused. The eye is insensitive to light and to touch. One side of the body is paralysed and lies helpless. If you lift

the paralysed arm or leg it falls back a dead weight. If you pinch, tickle, or prick the palm of the hand or sole of the foot on the paralysed side it will not be withdrawn, while on the other side it is slowly pulled up.

The body is paralysed on the side opposite to the apoplexy, for if the blood-vessel has burst on the right side of the brain, the left arm and leg will be found insensitive and paralysed. This is due to the crossing of the nerves in the medulla oblongata, those from the right side of the brain passing to the left side of the body. The pupils are unequal; one dilated, the other normal; or one or both pupils may be contracted (see Figs. 109 and 110).

Fig. 109.—Dilated pupil of apoplexy.

Fig. 110.—Normal pupil.

Fig. 111.—Pin-hole pupil of opium poisoning.

Fig. 112.—Dilated pupil of belladonna poisoning.

Treatment.—1. Loosen all tight clothing about the neck and chest.

2. Place the patient in bed *with his head raised.* If he has been attacked by this condition in the street, he should be carried home on a stretcher, and the head should be kept *higher* than the feet.

3. Towels wrung out of cold water should be applied to the head and back of the neck, and be changed every three or four minutes.

4. Hot bottles should be applied to the feet, but with the precautions above-mentioned (see p. 63).

5. Medical aid should be at once summoned.

6. No stimulant should be given.

An apoplectic seizure is sometimes simulated by malingerers, but the pupils will be found to be equal, and pain will be felt on pinching the skin of the limbs, the part being speedily withdrawn.

IV **Alcoholic Intoxication.**—Extreme alcoholic intoxication is very difficult to distinguish from apoplexy. In any case of complete insensibility and helplessness, even where the patient has become unconscious in a public-house, or has the odour of an alcoholic beverage, and where one might actually suspect intoxication, he should not be left to "sleep off" his

supposed carouse, but should be carefully watched and cared for till his condition is exactly ascertained. Apoplexy has often been mistaken for alcoholic intoxication, and, most unfortunately, treated by isolation in a prison cell. Policemen are specially to be warned against this error, by which many a dying patient has been treated with the scant ceremony usually meted out by the force to "a drunk."

The pupils in profound alcoholism are generally dilated, and both sides of the body are equally powerless. The patient will wince when the clear part of the eye is touched by the tip of the finger, showing that insensibility is not complete.

Treatment.—In extreme cases of intoxication, where the condition cannot be immediately distinguished from apoplexy, the first-aid treatment for the latter condition should be carried out.

In less serious cases, where there is no reason to suspect anything but intoxication, an emetic may be administered, or the person may be left to "sleep off" the effects of his indulgence. Hot coffee or tea may in either case be given him afterwards.

V. **Epilepsy, or Falling Sickness.** — Epilepsy or falling sickness is the name given to a condition due to disease of the brain, and characterised by the frequent recurrence of "epileptic fits," of which "convulsions" and unconsciousness form the most prominent symptoms.

Symptoms of Epilepsy.—An epileptic patient usually has "a warning" that his fit is coming on by a peculiar cold or creeping sensation, by a feeling of numbness, or by profuse sweating. He utters a sharp shrill cry, falls suddenly unconscious, with the muscles rigid. After two or three seconds the convulsive stage is reached, and the arms and legs are then jerked or twitched violently towards the body. There is also twitching of the eyes and of the muscles of the face, and chattering of the teeth. Foaming at the mouth is usually present, the foam being streaked with blood, from the tongue being bitten. The convulsive stage lasts for a few minutes, and is followed by a period of partial unconsciousness which may pass off in a minute or two, or continue for half an hour. A patient after an epileptic fit feels much exhausted, and generally falls into a deep sleep.

Epileptiform convulsions are convulsions very similar to those of epilepsy, and are due, not to disease of the brain, but to temporary irritation of the nervous system. They are frequently found in children during the teething stage from the age of six months to two years, and are due to the irritation of the nervous system caused by the eruption of the teeth. "Teething fits" are not to be neglected, and should be attended to as described

under epileptic fits, with the addition that the child should be placed in a warm bath. A medical man should be called in at once, as the condition is often a most dangerous one.

Treatment of Epilepsy.—The first-aid treatment consists in preventing the patient from hurting himself during the convulsive stage. This is secured by placing a piece of wood between the teeth to prevent biting of the tongue, and by gently holding the patient to protect the arms and legs from being dashed against furniture, &c., during the convulsions. Tight clothing round the neck should be loosened, and after the fit is over the patient should have beef tea, or warm tea or coffee.

No epileptic workman should be allowed to climb a ladder, or do carpenter or slater work on a roof, lest he be attacked by a fit whilst in a dangerous position. A strong fire-screen should always be placed in the room where an epileptic patient lives, as many horrible burning accidents have happened to epileptics from the want of such a simple precaution.

VI. Opium Poisoning.—Opium poisoning is here selected as a typical example, as being the most commonly found form of narcotic poison. Opium poisoning is caused by the eating or smoking of solid opium, or by its being swallowed in the form of morphia, laudanum (tincture of opium), or chlorodyne. The most prominent symptoms are langour, passing on to drowsiness and complete insensibility. The condition of the pupil, or "black of the eye," is of great assistance in recognising this condition. In opium poisoning the pupil is greatly diminished in size, and looks not larger than a hole made by an ordinary pin in a sheet of paper. It is for this reason known as the "pin-hole" pupil (see Fig. 111). Additional assistance in coming to a decision will be got if the bottle from which the laudanum or chlorodyne has been taken, be found lying near the patient.

Opium poisoning may sometimes be confused with apoplexy. The distinctive points are the history of the case, and specially the "pin-hole" pupil of opium poisoning. Moreover, in opium poisoning both sides of the body are equally helpless, and the patient is not at first so insensible as not to be able to withdraw the hand or foot when the skin of these parts is pinched or pricked.

Treatment.—The treatment in opium poisoning consists first of all in removing the poison from the stomach before it is absorbed into the system. A stomach pump in the hands of a medical man is the best means to effect this, but much may be done by the administration of emetics, which cause the patient to vomit and to evacuate the poison along with the contents of

the stomach. If possible, strong emetics should be sent for to the chemist in the form of sulphate of zinc (20 grains), or ipecacuanha wine (½ ounce). The latter should be given in teaspoonful doses every five minutes until vomiting occurs. If the special emetics mentioned cannot be speedily procured, or, in any case, till the time of their arrival, one of the following handy emetics may be employed:—

(*a*) Large draughts of warm water.
(*b*) Salt and water, a tablespoonful to the tumblerful.
(*c*) Mustard in water, one teaspoonful to the tumblerful.
(*d*) Tickling the back of the throat (see Chap. XI. on Poisoning).

Having brought about vomiting, you must next prevent, as far as possible, the action of the poison already absorbed. Thus, in the case of strychnine you should restrain the patient, and prevent him injuring himself in the throes of the convulsive seizures. In opium poisoning *the* thing to aim at, at this stage, is to prevent the patient from going to sleep. He should, therefore, not be allowed to lie down, but should be kept continually on the move, supported if necessary on either side by attendants, and best by two active policemen. He should further be stimulated if necessary by throwing cold water over his head and chest, and by flogging him on the back, arms, and hands with towels. During the intervals of this active treatment, strong coffee should be given.

VII. **Convulsions and Unconsciousness due to Kidney Disease.**—Convulsions and unconsciousness may come on suddenly in the course of Bright's disease—an affection in which the kidneys are inflamed. Unconsciousness resulting from this cause is known as uræmic coma, from the fact that it is due to a poisonous substance known as "urea," which is in health excreted by the kidneys, but which the kidney has not in this disease power to get rid of, and which, therefore, accumulates in the blood and affects the brain (1) by causing excitement to the nervous system, as is shown by the convulsions; or (2) by depressing the nervous system and causing stupor.

Treatment.—A patient known to be suffering from kidney disease suddenly becoming unconscious, and this condition being suspected, should be placed in bed between warm blankets, and hot bottles packed round him to encourage sweating. Medical aid should be got as soon as possible.

VIII. **Concussion and Compression of the Brain.**—Concussion of the brain is caused by a severe blow or fall on the skull, and the prominent sign is that the patient is "stunned,"

and unconscious. The insensibility may pass off in a few minutes, but in severe cases will continue, and may prove fatal. In compression the brain is pressed on by effused blood or by a piece of bone driven in upon it, as in the condition already described as "depressed fracture" of the skull. The signs are, in addition to the history of the accident, a gradually deepening unconsciousness, inequality of the pupils, deep stertorous breathing, and loss of power in the limbs. The symptoms, in short, are very similar to those already described under "fracture of the base of the skull" (see p. 63).

Treatment.—The treatment is similar to that of basal fracture of the skull, and consists in:—

(*a*) Keeping the head raised in bed.
(*b*) Application of cold to the head by towels wrung out of cold water, and constantly changed.
(*c*) Loosening of all tight clothing about the head, chest, and abdomen.
(*d*) Application of warmth to the feet in the shape of hot bottles well covered with flannel to prevent burning in an insensible patient.
(*e*) *Stimulants should not be administered.*

IX. **Shock and collapse.**—The history of a severe wound or burn in the one, or of severe hæmorrhage in the other, will help you to recognise insensibility when due either to shock or collapse. The special symptoms and treatment of these conditions are detailed under shock and collapse, to which the student is referred (*vide* pp. 84 and 85).

X. **Suffocation.**—Insensibility is a symptom of suffocation from choking, or from the inhalation of poisonous gases or chloroform. For the symptoms and treatment of this condition the reader is referred to the chapter on Suffocation.

CHAPTER IX.

ASPHYXIA AND DROWNING.

DROWNING—PHENOMENA OF DROWNING—TREATMENT OF THE APPARENTLY DROWNED—ARTIFICIAL RESPIRATION—SYLVESTER'S METHOD—DR. MARSHALL HALL'S METHOD—DR. HOWARD'S METHOD—ARTIFICIAL RESPIRATION IN YOUNG CHILDREN.

ASPHYXIA or suffocation is the name given to the condition which is brought about when respiration is seriously interfered with or stopped. It may be caused by pressure on, or blocking of, the air passages, as in strangulation, drowning, and choking; or by the inhalation of poisonous gases instead of pure atmospheric air, as in poisoning by coal gas. In asphyxia there is a congestion of venous blood on the right side of the heart.

Drowning.—Drowning is the most common form of asphyxia and is caused by obstruction of respiration from immersion in water, by the water covering and entering the mouth and nostrils, and preventing air being drawn in.

Phenomena.—The person may sink and rise a few times to the surface, drawing fresh breaths every time that his head is above water. The inspiratory efforts are ultimately made under water with the result that water is sucked partly into the stomach and partly into the lungs, and with the water are carried foreign bodies floating in it, such as straws, particles of sand, &c. The water at length fills up the bronchial tubes completely, and from consequent impossibility of drawing in air the person becomes asphyxiated. The face becomes swollen and livid from the congestion of venous blood on the right side of the heart. There is ultimately a convulsive stretching of the whole body and respiration ceases.

As the word "asphyxia" means "pulselessness," it is worthy of notice that in that sense it is not a correct name for the condition produced in drowning, *as the heart goes on beating to the last, and in fact for some seconds after the complete stoppage of respiration.* It is on this fact that the first-aid treatment of drowning depends for its efficacy. It should be remembered that the heart will go on beating for at least four minutes after submersion. Cases are recorded in which persons have been resuscitated after five minutes total submersion, but, as a rule,

great difficulty is experienced in bringing round a person who has been two minutes *under water*. This, of course, does not refer to the actual time in the water, as a person may be fifteen minutes in the water and the heart be still beating, if during part of the time the person has been floating on the surface owing to the buoyancy of the clothes, or a partially successful attempt at treading water or swimming. No treatment will be of any value if the heart has stopped beating, but it is often difficult in such cases even with a stethoscope and a trained ear to say absolutely that the muscle of the heart has stopped contracting, and that the circulation of the blood has absolutely stopped.

Treatment of the Apparently Drowned.—This divides itself into three parts and should be carried out in the order indicated below :—

1. The removal of the sources of obstruction to the breathing.
2. The re-establishment of the respiratory movement by artificial respiration.
3. The promotion of circulation and warmth.

1. *The Removal of the Sources of Obstruction to the Breathing.*—This is secured by attending to the following three points :—

(*a*) The removal of the water from the air passages by tilting the head backwards, or by turning the patient on his face for a second or two.

(*b*) The removal from the mouth and throat of mud, straws, or other foreign bodies by a handkerchief or finger.

(*c*) The pulling forward and fixing of the tongue. In the insensible condition the tongue falls backwards, and allows the epiglottis or cartilaginous valve which is attached to it to close down over the entrance to the larynx, and so to prevent respiration.

The tongue should be kept forward by any of the three methods now to be detailed :—

(1) After the tongue is pulled forward it may be retained in position by an elastic band passed over it and fixed under the jaw.

(2) A piece of string may be tied over the tongue and under the lower jaw.

(3) The lower jaw may be pressed forward by a thumb placed behind its angle. The tongue being attached to the jaw will be carried forwards by the forward movement of the jaw.

The measures detailed above should be very quickly carried out. Spectators should not be allowed to crowd round the person lest they obstruct the free passage of air, or hamper the movements of the operator and his assistants. The second and

most important part of the treatment—viz., the re-establishment of the respiratory movements—should then be begun.

2. *The Re-establishment of the Respiratory Movements by Artificial Respiration.*—Artificial respiration aims at copying the inspiratory and expiratory movements of respiration, by pulling air into the chest and expelling it at regular intervals, and at the same rate as obtains in health.

The average rate of breathing in an adult is about seventeen times per minute, or, roughly speaking, every four seconds. The inspiratory and expiratory phases, then, of a single respiration, take each about two seconds to run their course.

There are different methods of performing artificial respiration. The best known and most reliable method, and the one most

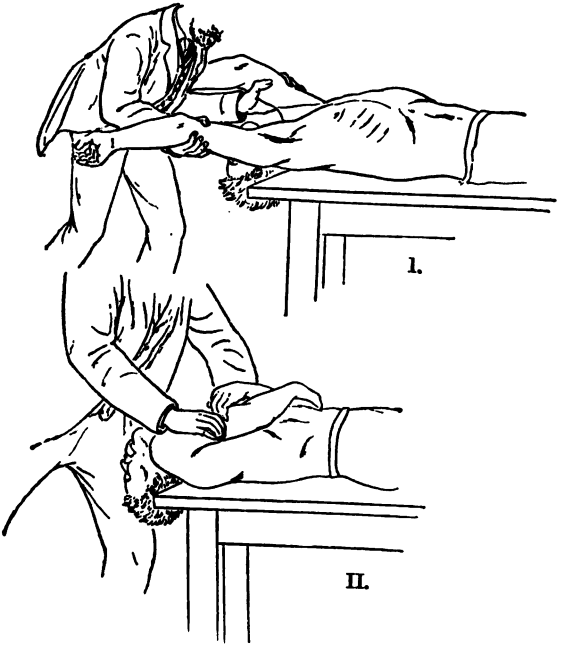


Fig. 113.—Sylvester's method of artificial respiration. I. Inspiration. II. Expiration.

useful for the ambulance pupil to learn and to practice is the method introduced in 1857 by Dr. Henry Sylvester.

Sylvester's Method of Artificial Respiration.—Having cleared the air-passages and taken steps to prevent the falling back of the tongue, the ambulance pupil places himself at the patient's head, in the position shown in Fig. 113. He as quickly as possible loosens all tight clothing about the neck, chest, or abdomen of the patient, unfastening braces, waist band, or corset, and slitting up, if necessary, as time is precious, the tight parts of clothing with a pen-knife. He then begins to imitate the natural respiratory movements in the following way:—Inspiration is copied by drawing the patient's arms up above his head, as shown in Fig. 113. The drawing up of the arms pulls upon the ribs and produces a vacuum in the chest, into which air is sucked. The expiratory phase is copied by pressing down the patient's arms, and particularly the elbows, firmly against the ribs. This lateral compression of the chest tends to force out the air lying in the air sacs and bronchi. These artificial inspiratory and expiratory movements have to be conducted alternately at the proper rate and in correct ratio. To carry out Sylvester's method of respiration properly, the plan of procedure is as follows:—The arms should be grasped at the elbows and drawn slowly upwards till they occupy the position shown in Fig. 113. The operator should then slowly count "one," "two," and then bring the arms down smartly to the patient's sides, pressing them firmly against the chest wall, so as to compress the thorax laterally. No undue force must be employed, as it is possible by rough handling to fracture the ribs. Again, allowing an interval by counting slowly, "one," "two," he should repeat the first movement, and so on. The object of counting is to give one some idea of the proper speed, because in rendering first aid in such a case the person doing artificial respiration is apt to become excited, and to pump away at the patient's chest at the rate of thirty or forty times a minute, instead of imitating the natural rate of breathing, which is approximately fifteen times per minute. Artificial respiration has often to be continued for a considerable time—even an hour or more—before natural breathing is re-established. It should not be discontinued until it is absolutely certain that the heart has stopped beating. It may be some considerable time before the patient gives the first indication of recovering, which is generally a deep sighing inspiration; when that has been heard the operator may feel satisfied that his labours will be crowned with success, and he must then endeavour to make the artificial respiration correspond with the natural though feebly established breathing of the patient. The artificial inspiration and expira-

tion should never be allowed to hinder or counteract the natural movements of the chest. It should, when breathing is partially established, exactly correspond with the similar phase of the respiratory act—*i.e.*, compression of the chest should coincide with natural expiration, raising of the arms with natural inspiration. It is recommended also that cold water be dashed on the face and chest, and ammonia salts held to the nose to encourage the breathing.

Other methods of artificial respiration have been described. The oldest plan is that of Dr. Marshall Hall in which expiration is produced by laying the body face downwards over a folded coat or pillow, when the chest will be compressed antero-posteriorly by the weight of the body, and air will be forced out. This may be assisted, if necessary, by pressing with the flat of the hand on the patient's back. The body is then turned on its side, when expansion will take place, owing to the cessation of the compression, and air will be sucked in and the inspiratory phase of respiration be imitated. The objection to this method, however, is that one side of the chest is alone compressed, and that expansion of the lung can take place only on the upper and non-compressed side. The turning of the body to produce expansion and respiration must, of course, be done slowly, so as to imitate natural breathing. It is a method far inferior to Dr. Sylvester's. Another method recently recommended by Dr. Howard of New York, less fatiguing than Dr. Sylvester's method and equally reliable, consists in kneeling astride the patient and compressing the chest with a hand on either side. By throwing the operator's weight forwards on the patient's chest-wall, the ribs and breast bone are thrust backwards, and so expiration is produced. The operator then throws himself back into the upright position still kneeling, taking his hands off the chest, thus releasing the chest-wall from pressure and allowing it to expand, and by its expansion to draw air into the chest.

Artificial Respiration in Young Children.—In young children, where the chest-wall is easily compressible, artificial respiration may be very readily and easily carried out by compressing the chest-wall from front to back by a hand placed over the breast-bone and middle area of the chest. Inspiration is produced as in Dr. Howard's method by releasing the pressure and allowing the chest-wall to spring back into its natural position. If by this means natural respiratory movements are not readily induced, Dr. Sylvester's method should at once be had recourse to. Schultze has recommended that in infants artificial respiration

should be carried out by seizing the child by the shoulders and holding it up with its legs dangling in the air. The child is then thrown over so that its head is down and its feet up, and in this way the chest is compressed. It is then tilted over into the first position when the chest expands.

The Laborde system of artificial respiration is also worthy of notice. It can be carried out with less trouble than any of the other methods, and is said in certain cases to be more efficient. The principle of this method consists in exciting respiratory movements by pulling rhythmically on the tongue. The mouth being cleared, the tongue is seized and is pulled forwards and held for a second in that position, when it is again allowed to slip back into the mouth. These rhythmical contractions and relaxations of the tongue should be effected at the rate of fifteen to twenty times per minute.

Reference must here be made to the excellent work done in this respect by the Life Saving Society of Great Britain. The Life Saving Society has, as one of its main objects, the promotion of technical education in life saving and resuscitation of the apparently drowned. In addition, to encourage the teaching and practice of swimming, it has also, for the instruction of the members of classes conducted under its auspices, prepared a regular *drill* in life saving, artificial respiration, and resuscitation. Different methods are taught, first by "land drill" and then in the water, of rescuing the drowning, and the classes are then put through in succession Sylvester's, Marshall Hall's, and Howard's methods of artificial respiration. A handbook of this drill has been issued, and may be had on application to the Secretary of the Life Saving Society, 3 Clarendon Square, London, N.W. The excellent combination of the teaching of the different plans of rescue, along with the methods of resuscitation, accounts in some degree for the splendid work done by the Life Saving Society.

3. *The Promotion of Warmth and Circulation.*—This is of importance, and should be attended to as soon as possible during the performance of artificial respiration. The obstructed circulation in the venous system may be assisted by chafing the hands and feet, and by rubbing the arms and legs from below upwards. The work should be entrusted to two or three assistants. As soon as possible warm dry clothing should be procured for the patient. He should be put into bed between warm dry blankets, with hot bottles to his feet and under his arm-pits. Stimulants should now be administered to him, and best in the form of hot coffee.

The following excerpt from the Aberdeen Police Reports shows what may be done by skilful and timely treatment on the part of an ambulance student. Many similar cases might be cited. Report anent case of immersion at Regent Quay:—

J. F., Sergeant, Aberdeen City Police, states—

About 11.10 p.m., on 4th June, 1891, while on duty on Regent Quay along with Constable T., I was informed that a man had fallen into the water. I at once went to the place, and saw a man, J. F., labourer, residing in V. Street, being pulled out of the water on to the quay. He appeared to be lifeless, and I was informed that he had been five minutes in the water. I turned him on his face at once, pulled out his tongue, and wiped his mouth with my finger. I then took off his coat, folded it into a pad, and turned the man on to his back, placing the coat under his shoulders, and stretched him to full length. I then slackened the clothes about his neck and breast and started artificial respiration (Dr. Sylvester's method), which I continued for fifteen minutes, when the patient commenced to breathe. I kept it up for a few minutes longer until the breathing became stronger. He was then carried into a shop near by, and his wet clothes taken off, and wrapped up in warm clothes, after which I commenced to rub his limbs upwards to cause circulation. By this time Dr. M. arrived, and stated that everything had been done for the man that could have been done, and that he was out of danger and could be removed to the Police Office, where he was conveyed on a stretcher, and placed in a bed with hot blankets around him, and bottles of hot water placed under his arm-pits and to the soles of his feet. About two hours afterwards he had quite recovered.

CHAPTER X.

SUFFOCATION.

ATTEMPTED HANGING OR STRANGULATION—CHOKING—BLOCKING OF THE LARYNX FROM SWELLING OF ITS MUCOUS MEMBRANE — CAUSES — DIPHTHERIA AND CROUP—SUFFOCATION DUE TO THE INHALATION OF POISONOUS GASES—POISONING BY CARBONIC ACID—POISONING BY CARBONIC OXIDE GAS—POISONING BY THE VAPOUR OF CHLOROFORM—TREATMENT OF SUFFOCATION DUE TO POISONOUS GASES.

SUFFOCATION is caused either by physical means—*e.g.*, pressure on or blocking of the larynx or windpipe, or by the inhalation of poisonous gases instead of pure air. The signs of suffocation caused by physical means are in addition to the history of the case, the prominence of the veins of the neck and face, blueness of the face, insensibility, and, it may be, convulsions. The patient in accidental cases generally complains of a sense of fulness in the head, and ringing in the ears. Suffocation produced by physical means may be either accidental or suicidal. In cases of hanging or strangulation it is, as it meets the ambulance student, generally a case of attempted suicide.

The most common ways in which suffocation is caused by obstruction to the passage of air into the lungs, may be divided; for the sake of description and treatment, under the four following heads :—

1. **Attempted Hanging or Strangulation,** where the obstruction to the passage of air is caused by the pressure of a cord on the windpipe. In attempted hanging the patient will be found suspended by a cord, scarf, or similar material. In strangulation the neck is encircled by a ligature which is causing the asphyxia.

Treatment.—In attempted hanging the patient should be immediately released, by having the cord loosened or cut from the neck. In strangulation the ligature should be similarly released or cut. A free current of air should be allowed to pass over the patient's face; the window or door of the room should be opened, or the person may be carried into the open air. All tight clothing round the neck should be loosened, as well as the braces and waist band of the patient. Cold water should be dashed over the neck, head, and chest to excite respiration. Failing immediate

recovery, artificial respiration should at once be resorted to. As in all cases where artificial respiration has to be performed, no unnecessary crowding of spectators or assistants should be allowed.

2. **Choking.**—Choking is caused by a morsel of food or a foreign body—*e.g.*, a plate of false teeth—accidentally swallowed being sucked into the larynx during respiration, the valve-like epiglottis having failed to shut down properly and to cut off the air-passages from the mouth during the act of swallowing. The foreign body usually lies partly in the mouth and partly in the larynx.

Treatment.—It should be extracted, if possible, by "clawing" with a finger put far back in the throat beyond the base of the tongue, the finger being protected against biting by a piece of wood placed between the back teeth. The irritation of a finger in the back of the throat may of itself cause vomiting, during which the patient may be relieved. The popular remedy of "thumping the back" is occasionally of service. In cases of complete obstruction, where the foreign body cannot be removed, it is often necessary to open the windpipe as the patient's only chance, and for that reason it is advisable that in a case of choking a medical man should be summoned as soon as possible.

3. **Blocking of the Larynx from Swelling of its Mucous Membrane.**—The mucous membrane of the larynx, either from accident or in disease, is apt to swell and become œdematous, and in severe cases the swelling is so great that the upper part of the voice box is entirely blocked and the ingress of pure air by inspiration is considerably, if not entirely, checked. This is sometimes found in the disease known as laryngitis or inflammation of the mucous membrane of the larynx which requires speedy treatment. It will occasionally happen that first aid has to be rendered in such a case pending the arrival of the doctor. The condition is fairly easily recognised by the following signs:—The patient complains of pain in breathing, in speaking, and in swallowing. He is hoarse and cannot speak above a whisper. There is pain in pressing over "Adam's apple," the patient looks pale and anxious, and gradually the difficulty in breathing increases until in severe cases marked symptoms of suffocation may set in. Till the arrival of a medical man the following measures may be employed:—A sponge wrung out of very warm water should be placed over the larynx, and should after a little be replaced by a mass of heated cotton wool, which is fixed in position by a triangular

bandage. The patient should be placed in bed in a room heated to a temperature of 60 to 70 degrees. Inhalations of steam should then be given with a regular inhaler (see Fig. 115), or with one extemporised from a jug with a towel folded round its upper part to act as a face piece (see Fig. 114). Water just "off the boil" should be used for the purpose of inhalation, and the patient should be made to inhale the vapour of steam for five minutes

Fig. 114.—Jug inhaler.

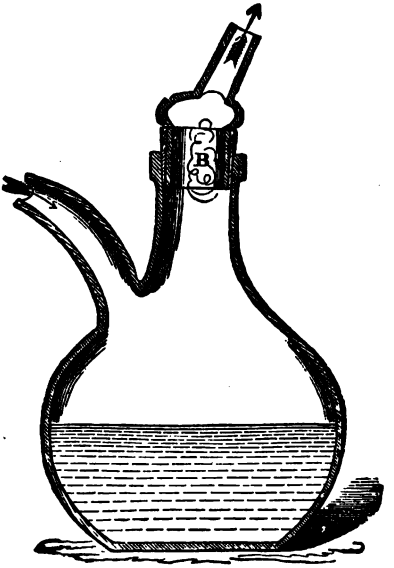


Fig. 115.—Regular inhaler.

at a time. If ipecacuanha wine be at hand the patient should have four or five drops of it every half-hour.

More commonly, however, the ambulance pupil is called to render assistance in cases where the mucous membrane of the larynx has become swollen and inflamed from accidental causes. The most common cause of this swelling is found in the case of a young child who has sucked the spout of a kettle containing boiling water. This swelling of the larynx is also found in cases of poisoning by corrosive acids or strong alkalies, where it is due to the irritation caused by the charring and burning of the mouth. Blocking of the larynx from these causes is a most serious condition and requires immediate medical assistance. Whether the cause be the swallowing or the inhalation of irritants the patient should have a poultice, warm compress of wadding, or a sponge wrung out of hot water laid over the larynx. He should be made to gargle the throat with demulcent fluids, as white of egg, milk, salad oil, or olive oil. In such cases the symptoms of shock are generally present and require treatment.

4. **Diphtheria and Croup.**—In diphtheria and croup obstruction to the inspiration of air is caused by a white membrane, which is formed by the disease, and which tends to invade the air-passages. In such cases, if symptoms of suffocation show themselves, it is expedient that a message be immediately sent to the medical attendant with a statement of the change in the patient's condition. In severe cases of impending suffocation due to these diseases it is very often necessary to perform the operation of tracheotomy—*i.e.*, to make an opening in the windpipe below the larynx and to admit air into the lungs through a tube fixed in the wound so made. The doctor, therefore, should be told of the change in the patient's condition so that he may bring with him the necessary instruments for the performance of this emergency operation. In the country, where the doctor's arrival cannot be expected for some time, relief may be given to the patient by applying over the larynx a warm sponge or dry poultice of heated cotton wool. Inhalations of steam may also be given by the ordinary or the extemporised inhaler, and it is also recommended that a moist atmosphere be maintained in the room in either of the following ways :—

If a bronchitis kettle (see Fig. 116) be at hand it should be

Fig. 116.—Bronchitis kettles.

arranged so as to play steam over the head of the bed. The steam may be kept playing over the patient by arranging a "tent bed" from a blanket spread on a clothes' screen and arranged round the upper end of the bed. A bronchitis kettle may be extemporised from an ordinary kettle which is placed on the fire, the steam from it being conveyed to the patient's bed, which is placed near

the fire, by means of a long spout of linoleum or brown paper attached to the kettle.

SUFFOCATION DUE TO THE INHALATION OF POISONOUS GASES.—The following are the most common accidents under this head :—

(*a*) **Poisoning by Carbonic Acid Gas (CO_2).**—This may occur in an over-crowded, non-ventilated room, in a closed-up underground passage or well, in the gallery of a mine ("choke damp"), or in a room that is on fire. A historical instance of poisoning by carbonic acid gas is to be found in the case of the Black Hole of Calcutta, where, in 1756, 146 prisoners were confined for a night in a room 20 feet square, with the result that 123 of the number died before morning.

(*b*) **Poisoning by Carbonic Oxide Gas (CO).**—Carbonic oxide gas is inhaled most commonly in the form of coal-gas. Coal-gas poisoning is not an uncommon accident, and is generally due to a person unaccustomed to gas, having blown, instead of turned, out the gas on going to bed. Several cases of gas poisoning have come under the writer's notice. Most of these occurred to country people accustomed to the use of paraffin lamps, who had on coming to town used gas for the first time. The blowing out of the lamp flame had become with them so much a matter of routine, that the gas was blown out without a thought of the consequences. Coal-gas poisoning also occurs from leakage from gas pipes, or from the imperfect turning of the stop-cock on a bracket.

(*c*) **Poisoning by the Vapour of Chloroform.**—Chloroform poisoning is either accidental or suicidal. In accidental cases it is generally due to the overturning of the chloroform bottle when the grasp of the hand of a person using the inhalation for toothache or asthma becomes relaxed on his becoming insensible. In suicidal cases a large quantity will usually have been poured on a handkerchief or towel placed over the face. It is quite misleading to believe the telling incidents given in novels, of persons having been immediately sent to sleep by a drop or two of chloroform on a handkerchief held on the face. It requires, as a rule, two or three teaspoonfuls of chloroform poured on a towel, and an inhalation period of four or five minutes to put a healthy adult under its influence.

Treatment of Suffocation due to Poisonous Gases.—In all these cases the patient should be immediately withdrawn into the open air from the poisonous atmosphere in which he is lying. The rescue of such a patient is often a matter of extreme difficulty,

particularly in the case of suffocation in a room that is on fire. The best means of rescue then is to crawl in on hands and knees, with a handkerchief tied loosely over the nose and mouth, and to keep the face as near as possible to the floor, for that is the place where the pure air will be, the heated air containing poisonous gases being lighter and rising to the roof. Groping in this way till you reach the suffocated person, whose probable position you will have ascertained before, you seize him, and, rising, carry or drag him into the fresh air.* In poisoning by coal-gas do *not* light a match to find the suffocated person, but make a rush to the window of the room and pull it up, or smash three or four of its panes. Thereafter, get the patient at once into the open air. In suffocation by chloroform vapour, pull off the towel or handkerchief and any other clothing soaked with chloroform, and get the person into another room or into the open air.

In all these cases loosen all tight clothing about the neck, chest, and abdomen of the patient. Dash cold water on the head, neck, and chest, and if recovery do not take place at once, start artificial respiration, and continue it till the arrival of a medical man. If the patient be insensible, the tongue should be pulled forward and fixed, as in the treatment of the apparently drowned.

* See Fireman's Lift, p. 136.

CHAPTER XI.

POISONING.

CLASSES OF POISONS — NEUROTIC POISONS — IRRITANT POISONS — KINDS OF NEUROTIC OR NERVE POISONS — I. NARCOTIC POISONS: OPIUM, BELLADONNA, CHLORAL, ETHER, ALCOHOL, PRUSSIC ACID—II. IRRITANT POISONS: (1) ACIDS: SULPHURIC ACID, NITRIC ACID, HYDROCHLORIC ACID, OXALIC ACID, TARTARIC ACID, CARBOLIC ACID—(2) ALKALIES: CAUSTIC SODA, CAUSTIC POTASH, LIME, AMMONIA — SYMPTOMS OF POISONING BY ALKALIES — SYMPTOMS AND TREATMENT OF POISONING BY ACIDS AND ALKALIES—(3) IRRITANTS PROPER: ARSENIC, IODINE, PHOSPHORUS, MERCURY, NITRATE OF SILVER, SUGAR OF LEAD—SYMPTOMS AND TREATMENT OF POISONING BY IRRITANTS PROPER.

ON the early detection of, and the application of first-aid methods in cases of poisoning often depends the success of the after-treatment. A general description of the symptoms and treatment of poisoning will be followed by a detailed account of the treatment of poisoning by some of the more commonly used drugs. For immediate reference in cases of emergency, the treatment of the more important poisons is given in tabular form at the end of the chapter.

There are two great classes of poisons:—

I. Neurotic poisons.
II. Irritant poisons.

Neurotic poisons act on the nervous system either by depressing it as in opium, or by exciting it as in strychnine poisoning. Irritant poisons cause a fatal issue, not only by their corrosive or irritant action on the parts with which they come in contact, but also by the shock which they produce. The symptoms of poisoning will vary according to the class of poison used. When there is any doubt as to the identity of the poison in cases of poisoning, whether accidental or suicidal, the ambulance pupil should remember that considerable assistance may be got from the history of the case and his observation of the surroundings. In suicidal cases there will have been a history of mental depression and melancholia, or of morbid mental

excitement, during which the patient may have threatened to make away with himself. In doubtful cases valuable information will be got from observation of the position of the patient, of the appearance of his mouth and throat, of the condition of his pupils, of the presence or absence of vomiting, and of the nature of the vomit, and of the extent and duration of the unconsciousness. The presence of a bottle of poison beside the patient is also an occasional help, as also the odour in the room, which, in cases of poison by prussic acid or chloroform, is so distinctive as to be absolutely diagnostic of the cause of the patient's condition.

Poisons may then be dealt with under the two great classes of **neurotics and irritants**:—

I. *NEUROTIC OR NERVE POISONS.*

There are two sub-classes of neurotic poisons:—

1. **Narcotic Poisons**—*e.g.*, Opium.—These are also known as cerebral poisons because they act on the brain.

2. **Convulsants**—*e.g.*, Strychnine.—These are also called spinal poisons because they act on the spinal cord, and the most prominent symptom of their action is the presence of convulsions.

1. **NARCOTICS.**—The prominent symptom is langour, passing on to drowsiness and to complete insensibility. A marked sign of narcotic poisoning is the condition of the pupil or "black of the eye," which in poisoning by opium is greatly diminished in size, and looks in advanced cases no larger than a pinhead. It is in this condition known as the "pinhole pupil," and is one of the chief signs of poisoning by opium or one of its preparations (see Fig. 117). In poisoning by belladonna, on the other hand, the pupil is very much enlarged (see Fig. 118).

Fig. 117.—Pinhole opium pupil.

Fig. 118.—Dilated belladonna pupil.

The narcotics which most claim our attention are:—

(*a*) **Opium.**—Opium may be taken by the mouth in the form of solid opium, morphia, laudanum (tincture of opium), or chlorodyne, or under the skin by a hypodermic injection of morphia. In the statistics of suicidal poisoning, opium heads

the list as the poison most commonly used. It is worthy of note that a very small dose, indeed, of opium may be fatal to infants and young children, and cases are recorded where two drops of laudanum administered to a baby have caused a fatal result. The common practice of giving narcotics to fretful children to make them sleep is a very dangerous one, and cannot be too much deprecated.

(*b*) **Belladonna,** taken in the form of belladonna berries, or as tincture or liniment of belladonna.

(*c*) **Chloral,** taken in the form of a salt (chloral hydrate), or as syrup of chloral.

(*d*) **Ether** and **alcohol,** in excessive doses.

(*e*) **Prussic acid.**

2. **CONVULSANTS.**—Convulsants first excite the nervous system, causing convulsions, and finally depress it. In addition to the convulsions, lock-jaw is occasionally present. The most commonly used convulsant is strychnine taken either in the form of the powder or as nux vomica beans or powder.

Treatment of Poisoning by Neurotics.—The first and most important part of the treatment consists in the removal of the poison from the patient's stomach before it is wholly absorbed into the circulatory system. This must be followed by an attempt to counteract by "antidotes" or otherwise, as far as possible, the poison which has been already absorbed.

Removal of the Poison from the Stomach.—This is carried out by the physician by the administration of emetics or "vomits," by the use of the stomach pump, and by the injection under the skin of a drug which causes vomiting. Till the arrival of the medical man, it is the duty of the ambulance pupil to use what means he has at his disposal in order to cause the poisoned patient to vomit. This may be carried out by tickling the patient's throat with the finger, and by administering one or other of the following "handy emetics," while some of the stronger and certain ones detailed below are being procured from the chemist:—

Emergency Emetics.—(1) *Large Draughts of Warm Water* have a certain power of causing vomiting.

(2) *Salt and Water.*—A tablespoonful of common salt dissolved in a tumblerful of water may be given, and repeated if necessary.

(3) *Mustard in Water.*—Mustard mixed in water, in the proportion of one teaspoonful of mustard to the tumblerful of water, may be given, and repeated every five minutes till vomiting occurs.

(4) *Common Salt.*—Dried salt may be given as a powder in teaspoonful doses.

(5) *Ipecacuanha Wine.*—This is a domestic medicine, and is often at hand. To an adult a teaspoonful should be given every ten minutes till vomiting occurs. In the case of a child, fifteen drops may be given every ten minutes.

Where a chemist is near, any of the following drugs should be sent for in case the emergency emetics are not sufficiently powerful in their action:—

(1) *Sulphate of Copper* may be given in 6-grain doses. The best way is to order 20 grains of sulphate of copper from the chemist, to dissolve it in a wine glassful of water, and to give a teaspoonful of the mixture every five minutes.

(2) *Sulphate of Zinc.*—The dose of sulphate of zinc that is used to cause vomiting in an adult is from 10 to 30 grains. A teaspoonful (1 drachm) of sulphate of zinc may be procured from the chemist, and dissolved in a wineglassful of water. A teaspoonful of this mixture may be given every ten minutes till vomiting occurs.

(3) *Ipecacuanha Wine*, if not at hand, should be procured from a neighbour, or from the nearest chemist. An ounce of the wine should be asked for, and it should be given in doses as mentioned under Emergency Emetics.

The Counteracting of the Poisoning already Absorbed.—Having brought about vomiting one must next as far as possible moderate the action of the poison already absorbed. You must not allow the patient to remain in the drowsy condition into which he has fallen, for if so it gradually deepens until death occurs. The patient should not be allowed to lie down, but should be kept continually on the move, supported if necessary on either side by attendants. He should be walked for an hour at a time round the room, or along a lobby, and best by two active policemen, whose assistance may easily be got in such a case. If the constant motion do not prevent the patient from sleeping and from dragging his feet on the floor, he should be further stimulated by throwing cold water over his head and chest and by flogging him on the bare back, arms, and hands with towels. One of the best antidotes to opium poisoning is strong black coffee, which should be given during the intervals of the active treatment detailed above. If coffee cannot be procured a strong infusion of tea may be given instead. In poisoning by prussic acid, cold water poured on the head and spine often proves of great service, and artificial respiration may have to be resorted to. In strychnine poisoning the patient should be

restrained so as to prevent him from injuring himself in the throes of the convulsive seizures. The convulsions are often so severe in strychnine poisoning that it is necessary for the medical attendant to check them by giving the patient inhalations of chloroform, or by administering bromide of potash or chloral by the mouth.

II. *IRRITANT POISONS.*

Irritant poisons may be divided into three great classes :—

1. Acids.
2. Alkalies.
3. Irritants proper.

1. **Acids.**—The acids which are most commonly found as the causes of poisoning are :—

(*a*) Sulphuric acid (oil of vitriol).
(*b*) Nitric acid.
(*c*) Hydrochloric acid (spirit of salt).
(*d*) Oxalic acid taken in the form of the powder as used for domestic purposes such as the cleaning of brass, or in the form of the binoxalate of potash (salts of sorrel).
(*e*) Carbolic acid.
(*f*) Tartaric acid.
(*g*) Acetic acid.

2. **Alkalies.**—The most important are :—

(*a*) Caustic soda.
(*b*) Caustic potash.
(*c*) Lime.
(*d*) Ammonia.

Symptoms of Poisoning by Acids and Alkalies.—The main symptoms of poisoning by acids and alkalies are due to their strong corrosive action. They char and burn the tissues, and cause shock to a very marked degree. They stain, irritate, and may even destroy the parts with which they come in contact. The lips are generally found to be burned and stained. The colour of the stain depends on the poison used. Oil of vitriol causes a black staining, nitric acid a yellowish colour, while a white colour is found in poisoning by hydrochloric acid, and most of the strong alkalies. The mouth is swollen and painful, and in parts corroded. The gullet and stomach may be similarly affected. Intense shock is usually present. The patient will probably have vomited, and if so the vomit should be preserved for examination by the medical attendant on his arrival. The vomit may contain blood and shreds of charred

mucous membrane. The patient usually complains of cramp, of pains in the stomach, and of thirst, and may have convulsions.

Treatment of Poisoning by Acids and Alkalies.—Soothing and demulcent drinks should *at once* be administered. The best of these are milk, white of egg, white of egg in milk or gruel, olive oil, salad oil, or mucilage. The next part of the treatment consists in giving an antidote or corrective to neutralise the action of the poison. Alkalies are antidotes to acids—acids to alkalies. The emergency alkalies to be used in cases of poisoning by acids are lime water, chalk in water, wall plaster, carbonate of soda in water (a tablespoonful to the tumblerful), soap suds, whiting, and magnesia.

The common emergency acids given as antidotes to alkalies are acetic acid in the form of vinegar, citric acid in the form of lime juice, and tartaric acid.

Emetics or vomits are dangerous in cases of poisoning by acids, and should not be given. Medical aid should at once be summoned, and suicidal patients are on no account to be left without attendants. Shock, if present, should also receive its proper treatment (p. 85).

3. **Irritants Proper.**—In this class are included poisons which have a strong irritant action, but which have not the corrosive action of the acids and alkalies. The following are the most important of these:—

(*a*) **Arsenic.**—Arsenic may be taken in the form of a white powder or as coloured arsenic, or in the medicinal form of Fowler's solution (liquor arsenicalis). Arsenic is also present in fly-papers. The prominent symptoms are irritation of the eyes, throat, and stomach, palpitation of the heart, a rapid pulse, general restlessness, and delirium.

(*b*) **Iodine.**—Iodine is sometimes accidentally taken in the form of tincture, or liniment.

(*c*) **Phosphorus.**—Ordinary phosphorus is very poisonous. One or two heads of matches may be sufficient to poison a child. The heads of safety matches being made from allotropic phosphorus are non-poisonous. Rat-paste also contains phosphorus. The vomit of a patient poisoned by phosphorus will be luminous in the dark.

(*d*) **Mercury.**—Mercury is sometimes the cause of poisoning in the form of perchloride of mercury (corrosive sublimate), a substance which has been already described as a very strong antiseptic, and which is much in use for the washing of wounds.

(*e*) **Nitrate of Silver** (lunar caustic).—A patient poisoned by this has black stains about the mouth, and his vomit is also black.

TABLE OF POISONS AND THEIR TREATMENT.

			Treatment.
I. NEUROTIC POISONS,	1. NARCOTICS,	(*a*) Opium, laudanum, morphia,	Emetics, active exercise.
		(*b*) Belladonna,	Strong coffee, stimulation.
		(*c*) Chloral,	Emetics, sal volatile and very warm water.
		(*d*) Ether and alcohol,	Emetics, cold water to head and spine.
		(*e*) Prussic acid,	Artificial respiration.
	2. CONVULSANTS,	(*a*) Strychnine,	Emetics, restraint and protection from injury during convulsions, 10 grs. of chloral or bromide of potash if convulsions severe.
		(*b*) Nux vomica,	
II. IRRITANT POISONS,	1. ACIDS,	(*a*) Oil of vitriol,	Milk, white of egg, olive oil or salad oil, followed by alkalies—*e.g.*, chalk or wall plaster, lime water, carbonate of soda, water, whisky, soap suds, magnesia.
		(*b*) Nitric acid,	
		(*c*) Hydrochloric acid,	
		(*d*) Oxalic acid,	
		(*e*) Carbolic acid,	
		(*f*) Tartaric acid,	
	2. ALKALIES,	(*a*) Caustic soda,	Milk, white of egg, olive oil, or salad oil, followed by acids—*e.g.*, acetic acid (vinegar), citric acid (lemon juice), tartaric acid.
		(*b*) Caustic potash,	
		(*c*) Lime,	
		(*d*) Ammonia,	
		(*e*) Carbonate of potash,	
	3. IRRITANTS PROPER,	(*a*) Arsenic,	Emetics, perfect quiet.
		(*b*) Iodine,	Carbonate of soda in water, boiled starch.
		(*c*) Phosphorus,	Emetics, magnesia. No oils to be given.
		(*d*) Mercury,	Milk, raw eggs.
		(*e*) Nitrate of silver,	Strong solution of salt.
		(*f*) Sugar of lead,	Emetics, tablespoonful of Epsom salts in warm water.

(*f*) **Sugar of Lead.**—Sugar of lead, if taken in a poisonous dose, shows itself by colic, vomiting, cramp, and paralysis.

Treatment of Poisoning by Irritants Proper.—In poisoning by any of the substances given under the class of irritants proper it is not, as a rule, desirable to give strong emetics, but vomiting may be brought about by tickling the back of the throat, or by giving the patient large draughts of warm water, which will not only act as a diluent of the poison, but will also cause its rejection from the stomach. Any of the demulcents mentioned under the corrosive poisons may be given, such as milk, white of egg, olive oil, salad oil, or mucilage. In poisoning by phosphorus, however, oil should not be given. In poisoning by nitrate of silver the best antidote is a strong solution of common salt frequently administered. In poisoning by sugar of lead a teaspoonful of Epsom salts should be given. In poisoning by iodine carbonate of soda should be given along with boiled starch. In poisoning by arsenic a teaspoonful of sal volatile may be given, and, if necessary, artificial respiration may be resorted to. Medical aid should be at once summoned, and, in the event of a doctor not being readily procurable, the antidotes mentioned above may be administered. Should he, however, be at hand the special antidotes mentioned under the special poisons should be procured and made ready for administration. Shock is very commonly present in poisoning by irritants proper, and requires treatment.

CHAPTER XII.

BURNS, SCALDS, FROST-BITE, AND SUNSTROKE.

BURNS AND SCALDS—DEGREES OF BURNS—BURNS FROM GUNPOWDER—BURNS FROM LIGHTNING AND ELECTRICITY—BRUSH BURN—BURNS OF THROAT AND LARYNX—BURNS FROM CORROSIVE ACIDS AND ALKALIES—TREATMENT OF BURNS AND SCALDS—FROST-BITE—TREATMENT—SUNSTROKE AND HEAT STROKE—SYMPTOMS AND TREATMENT.

Burns are produced by the action of dry heat or scorching; **Scalds** by the application of moist heat, generally in the form of boiling water.

Degrees of Burns.—Burns have, according to the classification of Dupuytren, a French surgeon, been divided into six degrees, which, roughly speaking, may be described as follows:—

1st Degree.—A mere reddening of the surface.

2nd Degree.—Vesication or blistering, where the epidermis or superficial layer of the skin has been elevated from the *cutis vera* or "true skin" by serum.

3rd Degree.—Where the blister has burst, and the burn extends right down to the true skin.

4th Degree.—Where the whole thickness of the true skin is burned through.

5th Degree.—Where the charring involves the subcutaneous tissue and muscle.

6th Degree.—Where the part is burned down to the bone.

Burns from Gunpowder.—The surface of the body is frequently scorched by the explosion of a gunpowder charge or the firing of a blank cartridge close to the body. In such a case there may, in addition to the ordinary appearance of a burn, be considerable bruising and laceration. It very frequently happens that grains of gunpowder are forcibly driven into the skin, so as to entirely blacken it. Where the face is affected, in addition to this scorching and blackening of the skin from the ingraining of gunpowder, a complication often exists in a similar affection of the cornea, or clear part of the eye, which may end in extensive inflammation and ulceration of the cornea and outer coats of the eye. Where grains of powder have been in this way driven into the skin it is advisable, particularly in the face, to remove them as far as possible by washing with warm water and soft soap, or with warm water having in solution either soda or carbonate

of soda. The part should be gently sponged and rubbed with the solution until as much as possible of the gunpowder staining has been removed, or until the patient complains of feeling the rubbing very painful. The part should then be treated with Carron oil or smeared with cold cream, as described below. Where the eyes have been injured, a little olive oil should be poured between the lids, and the eye should then be covered by a layer of cotton wool soaked in Carron or olive oil, under a bandage.

Burns by Lightning.—The skin is scorched, and its surface frequently shows "arborescent" or tree-like markings. The injured person feels very sick, and suffers from shock, for which he has to be treated. A soothing dressing should be applied to the injured part.

Burns from Electrical Currents of High Tension.—Death is generally the result of such an accident, but if the patient be fortunate enough to escape this, there is great prostration and shock, which requires its appropriate treatment.

In cases of accidental contact with electric light wires, a condition of suspended animation may be produced, owing to an arrest of respiration. Artificial respiration should then be resorted to (see pp. 109 and 110).

Brush Burn.—Brush burn is the name given to an irritation or excoriation of the skin, caused by excessive friction of the surface, such as might be produced by rubbing tender skin forcibly with a nail brush, or by having the surface of the body brought in contact with machinery in motion. It is treated by washing the part with warm water, and smearing over it olive oil, Carron oil, vaseline, or cold cream (oxide of zinc ointment).

Burns of the Throat and Larynx.—The throat and larynx are generally burned either by corrosive acids swallowed accidentally, or by children sucking the spout of a boiling kettle. There is great danger from the resultant swelling, and the patient should be treated on the lines laid down on page 115.

Burns from Corrosive Acids and Alkalies.—In chemical works and pharmacies it is not uncommon for the hands, and occasionally other exposed parts of the body, to be burned by corrosive acids or alkalies. When vitriol or any of the other strong acids is the cause of the injury, relief is speedily obtained by dusting whiting over the part. Thereafter the ordinary treatment for burns may be carried out. Vinegar should be used as the first application in burns caused by caustic lime, soda, or potash. When the eye is burned by the acid lime-water should be used as a lotion, followed by the instillation of

olive oil, while for alkaline irritants weak vinegar may be similarly employed.

Treatment of Burns and Scalds.—(1) The initial stage of first-aid treatment in burning accidents very often consists in extinguishing the flames. Flames burn only in the presence of the air, and are as surely extinguished by the exclusion of air as by the application of cold water. The most common form of accident is for a lady's dress to catch fire. In such a case air should be excluded by wrapping a hearth-rug, mat, table-cover, rug, or coat tightly round the body over the burning part of the dress. The lady herself, if she have sufficient presence of mind, may anticipate or assist the means above recommended by immediately throwing herself on the ground and rolling on the burning dress. Cold water may also be used to extinguish the flames.

(2) A most important part of the treatment is the removal of clothing from the burnt part. This should be done most carefully, *and on no account should the blisters be broken.* The clothing should be cut off, a trouser leg or coat sleeve being divided along the seam. The stocking or sock will generally be found to be adherent to the blistered skin below, and should be removed first by dividing it along its whole length *on the side away from the burn*, and then by soaking the adherent part with oil, and gently drawing on it. If the soakage with oil is not sufficient, the best plan is to immerse the limb in a bath of cold water, and to float off the adherent portion of the dress.

"Never break a blister" is a golden rule in the treatment of burns. The old plan of pricking them with needles is a needless interference, a source of danger, and has nothing to recommend it.

(3) The third stage of the treatment consists in the *exclusion of air* and the *use of soothing applications.* Air may be prevented from reaching the part by immersing it in a bath of cold water, or by dusting flour on it, and covering it with a thick layer of cotton wadding. Painting the surface with ink, whitewash, or collodion also eases the pain. Procure from the chemist as soon as possible six ounces of **Carron oil**, which is the oil used in burning accidents at the Carron Iron Works, near Glasgow, and consists of a mixture of equal parts of linseed oil and lime water. An equally useful preparation is the liniment of lime, which may be got from any chemist. It consists of equal parts of olive oil and lime water. If neither of these can be procured, ordinary olive or salad oil may be employed. The oil should be poured from the bottle over the burned part, which should then be dressed with lint soaked

in oil, and covered with a layer of cotton wadding and a bandage.

When carbolic acid has been accidentally swallowed or applied to the skin, great relief may be got by applying vinegar to the burned mucous membrane or skin. Professor Carleton also advises its use as an antidote in carbolic acid poisoning, equal parts of vinegar and water being administered.

(4) As has already been mentioned, shock is very likely to be induced in the case of an extensive burn. It should be prevented, or treated if already present, by the use of stimulants, &c. (see under Shock).

Frost-Bite naturally falls to be considered along with burns, as it is a similar condition, caused, however, by excessive cold. From the prolonged action of cold a part becomes cold, white, and insensitive, owing to its circulation being interfered with. As in burning frost-bite causes redness, then blistering, and finally mortification of the exposed part. Frost-bite occurs generally in the extremities of the body—in the hands, feet, ears, and nose. This condition may come on in exposed parts, such as the ears and nose, without the person being aware of it. It is easily recognised by the blanched appearance of the part; and when the patient's attention is drawn to it, he will find the ear or nose to be quite cold and to be devoid of feeling. If it continue for some time, the circulation becomes absolutely stopped, and the frost-bitten part, from the want of nutrition, rapidly dies; it mortifies and becomes gangrenous. In cases of prolonged exposure the condition may be so severe as to leave no hope of saving the part, which either sloughs off or has to be amputated.

Treatment.—In ordinary and even in severe cases of frost-bite, most satisfactory results will be got by the use of the following measures promptly applied:—Take the patient into a room with no fire in it; rub the frost-bitten part with snow continuously for a considerably time (even an hour or more). Alternative plans are bathing it with iced water, or shampooing it with cloths wrung out of cold water. By this means the circulation in the part will be gradually but surely restored. Stimulants (alcoholic or otherwise) may be given after a time.

The way *not* to do it is to take the patient into a warm room, set him close to the fire, and use warm applications. Under such treatment, mortification is almost sure to occur, as the reaction is too great.

Sunstroke is the name given to a condition produced by exposure to intense heat, and attended by grave brain symptoms. Similar exposure causes **heatstroke,** but while sunstroke is caused *directly* by the heat of the sun, heatstroke is more common in the stoke-holes of engine-rooms (particularly those of steamers passing through the Red Sea), or in crowded and unhealthy barracks, where other factors come into play than solar heat. Heatstroke is also known as **heat-apoplexy.**

Symptoms.—Drowsiness, faintness, and collapse, sighing, and irregular respiration. The face is pale, pulse slow, pupils dilated. The temperature in heatstroke often runs high—*e.g.*, from 107° to 109° F. (98·4° being "the normal"). The mortality from this condition is very high, and in a certain proportion of cases death occurs instantaneously.

Treatment.—The treatment consists in the immediate application of **cold.** Cold water should be dashed over the head, neck, and chest. Ice may be applied to the head in an ice-bag. Cloths wrung out of iced water and frequently changed, are also of service.

CHAPTER XIII.

REMOVAL OF FOREIGN BODIES FROM THE EYE, EAR, NOSE, THROAT, AND TISSUES.

REMOVAL OF FOREIGN BODIES FROM THE EYE—FROM UNDER THE LOWER LID—FROM UNDER THE UPPER LID—FROM THE CORNEA OR CLEAR PART OF THE EYE—REMOVAL OF FOREIGN BODIES FROM THE EAR—DIFFICULTIES—TREATMENT—REMOVAL OF FOREIGN BODIES FROM THE THROAT—REMOVAL OF FOREIGN BODIES FROM THE TISSUES.

REMOVAL OF FOREIGN BODIES FROM THE EYE.—Foreign bodies, or "fires" as they are popularly called, have not uncommonly to be removed from the eye, and consist of particles of dust or granite, chips of steel, &c. They are found in different positions, and require special methods of treatment.

Fig. 119.—Method of removing foreign body from lower lid.

The three most common positions for the foreign body to stick are under the lower lid, under the upper lid, and on the clear

part of the eye or cornea. The patient's sensations generally guide you as to the exact position of the foreign body, and when the cornea is the seat of the injury you will most clearly fix the exact position of the foreign body by throwing the light of a candle or lamp flame obliquely over the front of the eye. The methods of treating foreign bodies in these three positions are as follows :—

(*a*) **Beneath the Lower Lid.**—Pull down the lid (as in Fig. 119) with the thumb or finger, and take off the foreign body with the corner of a handkerchief.

(*b*) **Beneath the Upper Lid.**—If the foreign body lie in the position shown in Fig. 120, the method of removal is to evert,

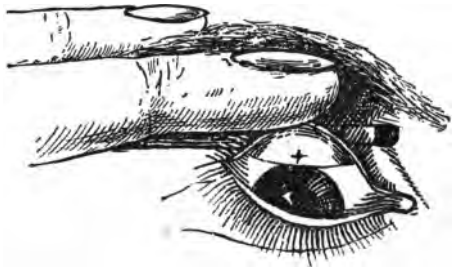


Fig. 120.—Method of everting upper eyelid over a match to remove foreign body (+).

or turn the lid over a match or probe, so as to bring its under surface to the front, when the object is wiped off with the corner of a soft handkerchief. If, however, the body lie high up behind the lid, at the upper junction of lid and eyeball, it cannot be reached in this way, and what should be done is to evert the lid as described above, and, with a camel's-hair brush, or the corner of a silk handkerchief, to sweep out the recess behind the lid.

(*c*) When the foreign body is a sharp one, as a chip of granite or steel, it, not uncommonly, sticks in front of the pupil on the clear part of the eye, where it gives rise to great pain and annoyance. No attempt should then be made to remove it, even by the artisan who has a reputation in his workshop for the treatment of "fires." Considerable injury is often done to the eye by the unskilful, daring, and often dangerous surgery of a well-meaning but injudicious fellow-workman. After a few drops of olive oil have been run in below the lids, the eye should be

bandaged and the sufferer should seek medical aid at once at hospital or home.

REMOVAL OF FOREIGN BODIES FROM THE EAR.—These generally consist of peas, beads, or beans which have been introduced into their ears by young children. The ear canal from the outside down to the drum is curved, with the convexity upwards, but can be straightened out by pulling the ear upwards and backwards. The foreign body often lies on the down side of the convexity of the curve (Fig. 121). The foreign body should *not* be romoved by seizing it with pincers, as such an attempt, even in skilful hands, is often fraught with considerable injury to the walls and drum of the ear. The best method is to wash out the ear with warm water thrown in forcibly by a syringe, the recoil from the drum acting on the foreign body from behind and forcing it out. This, however, is best left to the medical attendant.

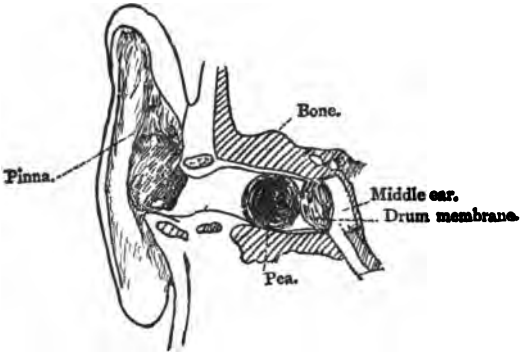


Fig. 121.—Section of ear, with foreign body.

REMOVAL OF FOREIGN BODIES FROM THE NOSE.—These are generally similar to the last-mentioned. They may be removed by blowing the nose forcibly, or if firmly stuck should be left to the medical attendant. The presence of a foreign body in the nose is not such a serious matter as to require the ambulance pupil's interference.

REMOVAL OF FOREIGN BODIES FROM THE THROAT.—These consist of fish-bones stuck in the palate, tonsils, or back wall of the pharynx. The mouth should be

examined under a good light, and if the spicule of fish-bone be seen, it should be removed by pincers or sugar-tongs, or by brushing the throat with a camel's-hair brush. Where the fish-bone has stuck in the gullet and cannot be easily removed, it has been recommended by Schliep that vinegar be given to the patient. The acetic acid in the vinegar softens a small fish-bone in fifteen or twenty minutes if repeated doses be given, and the foreign body is then said to cause less pain and to be easier of removal.

REMOVAL OF FOREIGN BODIES FROM THE TISSUES.—Needles, broken knitting-wires, pieces of glass, &c., which have been run in under the skin, should be removed at once if the end be seen, by catching and extracting them with pincers or sugar-tongs. If the needle have broken off short under the skin, the part of the broken needle left outside the body should be kept for the information of the medical man, who should be at once summoned.

The exact position of metallic foreign bodies in the tissues can now be most accurately determined by the Roentgen skiagraphy. The "new photography" is very serviceable where needles, pieces of glass, pellets, and bullets lie imbedded in the tissues, as steel, lead, and glass are impervious to the X-rays, and throw deep shadows on the photographic plate.

The accompanying skiagram (Fig. 121*a*, p. 134) is one taken for me by Dr. Mackenzie Davidson, of Aberdeen. The patient was a gentleman who had been accidentally shot at a grouse drive, and consulted me about the pellets lodged in his hand. These could not be exactly localised on examination, but the shadow-gram showed two of them to be lying in the soft parts, while a third was imbedded in one of the phalanges of the index finger. The ring on the little finger is very distinctly shown in the photograph.

When any of the accidents above described happen in the country at a distance from medical advice, it is advisable in sending a message to the doctor that the nature of the case should be distinctly stated to him, as he has generally to bring with him special instruments for the removal of the foreign body. A proper message in such a case often saves a great deal of time.

Fig. 121*a*.—Skiagram taken by the Roentgen rays of three leaden pellets imbedded in the hand.

CHAPTER XIV.

AMBULANCE TRANSPORT AND STRETCHER DRILL.

PRINCIPLES OF TRANSPORT — MODES OF TRANSPORT — SEATS — TWO-HANDED SEAT—THREE-HANDED SEAT—FOUR-HANDED SEAT—CLASS EXERCISE ON THE HAND SEATS — STRETCHERS — THE REGULATION STRETCHER — THE LOWMOOR JACKET — THE NORTON STRETCHER — WORTHINGTON'S STRETCHER — FURLEY-HEADLEY STRETCHER—EXTEMPORISED STRETCHERS—THE GREATCOAT OR COAT STRETCHER—THE RUG AND POLE STRETCHER—THE RIFLE STRETCHER—THE PLANK STRETCHER — THE POLE AND ROPE STRETCHER — THE HAMMOCK STRETCHER—THE UMBRELLA STRETCHER—STRETCHER BEARERS — THE MILITARY AMBULANCE WAGGON—THE CIVIL AMBULANCE WAGGON—THE "TORTOISE" WAGGON—THE BROUGHAM AMBULANCE—EXTEMPORISED AMBULANCE WAGGON—CACOLETS AND LITTERS—THE FURLEY-HEADLEY LITTER—THE ASHFORD LITTER—THE BICYCLE AMBULANCE —THE RAILWAY AMBULANCE WAGGON—STRETCHER DRILL—PREPARING STRETCHERS—LIFTING AND LOWERING PREPARED STRETCHERS—MARCHING WITH PREPARED STRETHERS—LOADING AND UNLOADING STRETCHERS WITH REDUCED NUMBERS: WITH THREE BEARERS: WITH TWO BEARERS—ADAPTED STRETCHER EXERCISE—GENERAL RULES FOR THE PROPER CARRIAGE OF STRETCHERS.

THIS most important part of "First Aid" instruction is, as a rule, expected to be mastered only by the male members of an ambulance class, while the subject afterwards treated under the title of "After-treatment" of ambulance patients is intended for lady students. There has been a tendency within recent years to teach members, not only of volunteer but also of public ambulance classes, the **Military** stretcher drill, and if this is once mastered, it can readily be adapted to civil stretcher exercises. The author has therefore incorporated the stretcher-drill exercises of the Medical Staff Corps in this chapter, as he has found this by far the best means of teaching stretcher work to policemen and other members of ambulance classes. He has also indicated the method of adapting these exercises to civil practice. The stretcher drill, described and illustrated below, is similar to the ambulance drill of the St. John Ambulance Association.

The principles of transport are to keep safe and at rest a patient who has had the appropriate "First Aid" treatment applied, and to carry him forward without vertical or lateral movement.

MODES OF TRANSPORT.—These are various, and will be taken up *seriatim*:—

1. **The Fireman's Lift**—where only one bearer is available.
2. **Hand Seats**—where two bearers are available.
3. **Stretchers**—where two or more bearers can be obtained—
   - (*a*) Regulation.
   - (*b*) Norton.
   - (*c*) Worthington.
   - (*d*) Furley-Headley.
   - (*e*) Extemporised.
4. **Ambulance Waggons**—
   - (*a*) Military.
   - (*b*) Civil.
   - (*c*) "Tortoise" Waggon.
   - (*d*) The Brougham Ambulance.
   - (*e*) Extemporised.
5. **Cacolets and Litters**, including the Furley-Headley Litter, the "Red Cross" Ambulance, the "Simplex" Ambulance, and the Bicycle Ambulance.
6. **Railway Ambulance Waggons.**

1. **The Fireman's Lift.**—This method, which is used by men of the fire brigades, consists in throwing the patient over one shoulder and holding him securely in position by his legs and one of his arms. It is particularly serviceable in removing an insensible patient from a room on fire. This is carried out by the bearer stooping down in front of the patient, grasping his right forearm with the left hand, then dragging the patient on to his shoulders, his legs being fixed by the bearer's right arm. The bearer then rises to the erect position, and has the patient balanced on his shoulders and fixed by his legs and right arm.

2. **Hand Seats.**—Two "bearers" are required, who should be strong men, and, as far as possible, of equal height. There are three kinds of hand seats:—

- (*a*) The Two-handed Seat.
- (*b*) The Three-handed Seat.
- (*c*) The Four-handed Seat.

(*a*) *The Two-handed Seat* is suitable for lifting patients from the ground. It is formed by the bearers, who face each other, and interlock the fingers of their right and left hands so as to form the seat, while they cross the other arms behind the

Fig. 122.—Method of forming two-handed seat.

Fig. 123.—Method of lifting by two-handed seat.

Fig. 124.—Method of carrying by two-handed seat.

patient, as shown in Fig. 122, to form a support behind the patient's loins.

The method of lifting a patient from the ground by the two-handed seat is shown in Fig. 123, where the bearers stoop down and form the seat under the patient, who fixes himself firmly in position by grasping their shoulders.

The method of carrying a patient by the two-handed seat is shown in Fig. 124.

(*b*) *The Three-handed Seat* is suitable only for carrying a patient who is able to raise himself on to it, and who has not to be lifted from the ground. It is formed by the bearer to the left in Fig. 125, and whom we shall call No. 1, grasping his own left wrist with his right hand, while bearer No. 2 grasps with his left hand the right wrist of No. 1, No. 1, at the same time, with his left hand grasping No. 2's left wrist. The right hand of No. 2 is then placed on the left shoulder of No. 1, so as to form a back support. This seat cannot be formed like the two-handed seat under the patient, but is used only to carry one who is able to support himself while being lifted.

(*c*) *The Four-handed Seat* cannot be used in lifting patients from the ground.

It is formed by both bearers grasping their own left wrists with their right hands, and then grasping each other's right wrists with their left hands, backs uppermost (see Fig. 126).

The method of carrying by the four-handed seat is shown in Fig. 127.

Class Exercise on the Hand Seats.—(1) Divide the class into two lines, each line to be numbered from left to right, and to face the lecturer. The odd numbers are the right files, the even numbers the left files. Each member should be about one pace distant from his neighbour.

(2) Go through the formation of the seats in the following order, and by the following words of command :—

"*Form Two-handed Seat!*"

This will be done in the way described previously.

"*Front!*"

Each member of the class will now turn, facing the lecturer.

"*Form Three-handed Seat!*"
"*Front!*"

"*Form Four-handed Seat!*"
"*Front!*"

Fig. 125.—Method of forming three-handed seat.

Fig. 126.—Method of forming four-handed seat.

(3) A part of the class should then be told off as patients, or boys may be used for the purpose. There should be a patient for each two bearers. The patients take up their position in front of the bearers, being seated on the ground in the case of the two-handed seats, and standing in the case of the three and four-handed seats.

The following orders should then be given :—

"*By Two-handed Seats, lift Patients !*"
"*Lower Patients !*"
"*Front !*"

"*By Three-handed Seats, lift Patients !*"
"*Lower Patients !*"
"*Front !*"

"*By Four-handed Seats, lift Patients !*"
"*Lower Patients !*"
"*Front !*"

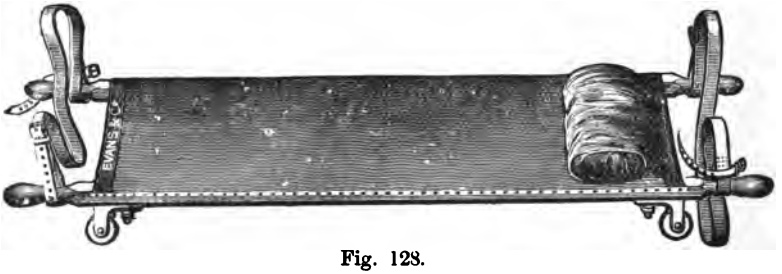


Fig. 128.

Fig. 129.

Figs. 128 and 129.—Regulation stretcher (open and closed).

One bearer may himself conduct the transport of a patient by allowing him to rest his weight on his shoulder, while he himself aids by taking the patient round the waist and helping him along. He may even lift and carry the patient in the ordinary school-boy style.

3. **Stretchers.**—(*a*) The *Regulation Stretcher* has poles 7 ft. 9 ins. in length, to which is fastened by copper nails a sheet of canvas, 6 ft. long, and broad enough to give the stretcher a total

width of 1 ft. 11 ins. The poles are fastened together at either end, just inside the handles, by a traverse or flat jointed wrought-iron bar.

Each stretcher has a small pillow and a couple of strong leather slings (Fig. 128).*

The stretcher can be closed for ease in transport (Fig. 129).

(*b*) The *Norton Stretcher.*—This stretcher was invented by Surgeon-Lieut.-Colonel A. T. Norton, commandant of the Volunteer Medical Staff Corps, and is most ingenious and serviceable. The stretcher bed has the advantage of being used either as a stretcher or a bed, and is, therefore, particularly useful for military ambulance work at manœuvres or in active service. It is fitted with collapsible legs and telescopic handles. The canvas is adjusted by means of two rods which are easily detachable; thus permitting the canvas to be cleaned or disinfected (see Figs. 130 and 131).

Fig. 130.—Showing Norton stretcher bed folded.

Fig. 131.—Showing it as a bed.

(*c*) Surgeon-Major Worthington, of the Canadian Volunteer Militia, has recently described an improved stretcher of his own invention for hospital, ambulance, and military use. This stretcher has the special advantage of being made under the patient instead of the patient being lifted on to it. As first used it consisted of eight pieces of pine, six of them being 30 inches in length, 4 inches in breadth, and $\frac{1}{4}$ inch thick; the other two 3 inches in breadth, $\frac{3}{4}$ inch thick, and the length of the patient's bedstead, inside measurement. The ends and edges were rounded and made perfectly smooth. The short pieces are passed under the patient from side to side at regular intervals from head to feet. The long pieces were then carefully inserted under the ends of the short ones. The apparatus can be put together in a minute, and is lifted by a person at each corner. Dr. Worthington believes that for field use the above put

* The stretcher may have a special jacket—known as the "Lowmoor jacket"—fitted to it for use in mines, ships' holds, &c., where it is desirable to fix a patient firmly on a stretcher which has at first to be carried vertically till the patient arrives on terra firma (see Fig. 150, p. 162).

together in sets with a wooden pin to be dropped into a hole at each corner would be more serviceable and in every respect better than the present army stretcher. It is fitted with hooks for slinging in the ambulance waggon. The accompanying illustration (Fig. 132) is copied from the *British Medical Journal*.

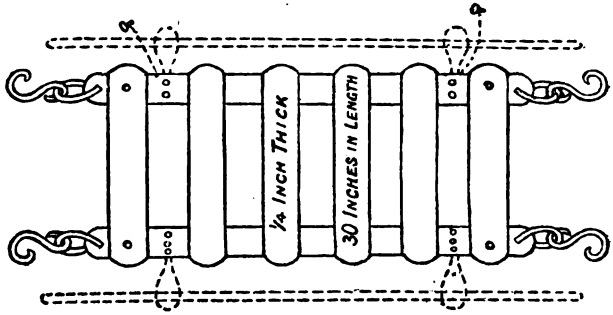


Fig. 132.—The Worthington stretcher.

(*d*) The "Furley-Headley" stretcher is made of two poles and a canvas bed with a wide hem down each side through which the poles are passed. The poles are kept apart by galvanized iron jointed traverses. At each end of the traverse is a U-shaped piece of iron into which the poles fit, and attached to the traverses are short legs with roller feet. This arrangement allows the poles and traverses to be removed: a patient can thus be left with only the canvas between his body and a bed or operating table.

Fig. 133.—The "Furley-Headley" stretcher.

(*e*) The *Extemporised Stretcher* may be made in a variety of ways:—

(1) The *Greatcoat* or *Coat Stretcher* is made by taking two coats or greatcoats, and through their sleeves, turned inside out, passing two clothes-poles or strong broom handles. The coats are then buttoned down the middle, and the appearance of the stretcher is shown in Fig. 134.

Fig. 134.—The greatcoat or coat stretcher.

Fig. 135.—The rug and pole stretcher.

(2) The *Rug* and *Pole Stretcher* is made by rolling two clothes-poles into a rug, beginning at the sides, until the width of rug left between the two poles is about 20 inches. The appearance of such a stretcher, and the method of carrying it, are shown in Fig. 135.

(3) The *Rifle Stretcher* is made in an exactly similar way to the last, only two rifles, with fixed bayonets, are used instead of the poles. The bayonets are required to give the stretcher sufficient length.

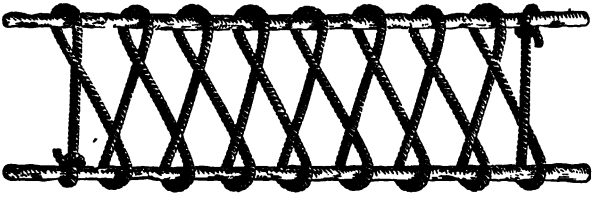


Fig. 136.—The pole and rope stretcher.

(4) A *Plank Stretcher* may be employed by taking a broad plank of wood, or a narrow door, and carrying the patient on that. The plank may be supported by the hands directly, or ropes may be placed from side to side across it near its ends, and the stretcher carried by four bearers holding the ends of the ropes at the sides.

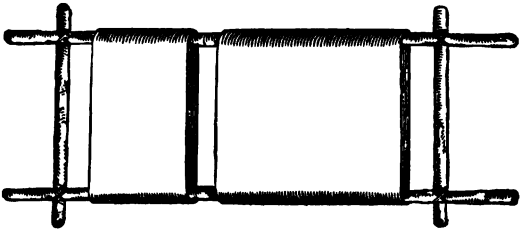


Fig. 137.—The extemporised canvas stretcher.

(5) The *Pole and Rope Stretcher* is made by selecting two strong poles, and making the body of the stretcher out of a long strong rope, which is wound from side to side alternately round each pole (Fig. 136).

(6) An extemporised stretcher may be made by nailing to two suitable rollers a piece of tent canvas, sacking, or strong cloth (Fig. 137).

(7) The *Hammock* stretcher (Fig. 138).—In suitable cases a patient may be carried in a hammock, which is attached at either

Fig. 138.—The hammock stretcher.

end to a long strong pole. The pole is supported on the shoulders of two bearers. Any one who has seen the Portuguese

Fig. 139.—The umbrella stretcher.

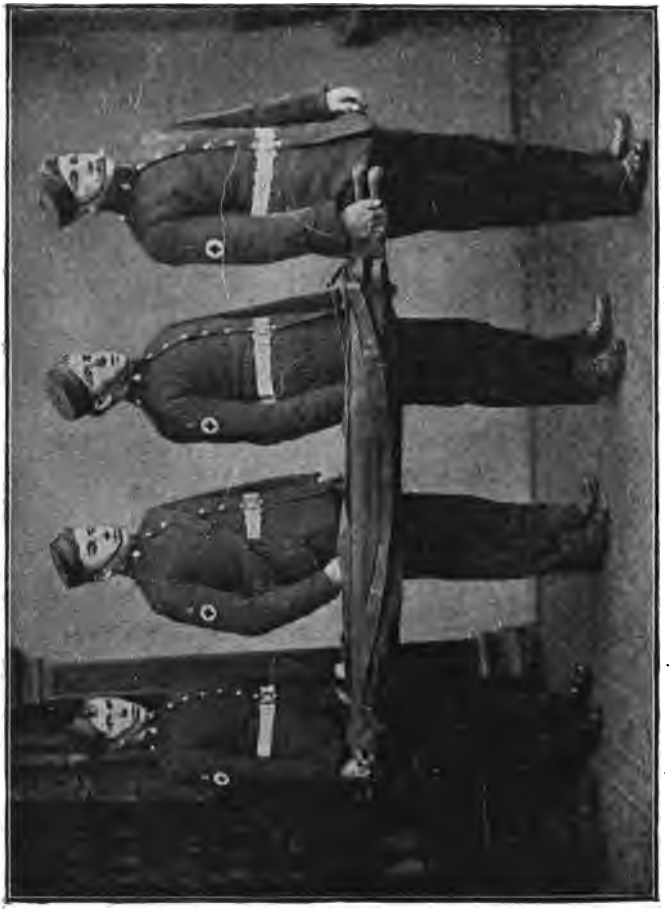


Fig. 140.—Arrangement of stretcher bearers.

hammock-bearers in Madeira using this means of transport, will agree as to the ease and comfort it affords, and recognise its suitability for many ambulance cases.

(8) *The Umbrella Stretcher.*—Where no suitable stretcher poles are at hand, they may be extemporised as shown in Caird and Cathcart's *Surgical Handbook*, and illustrated above (Fig. 139), where walking-sticks and umbrellas are made to serve the purpose of poles by being loosely bound together. A "coat"

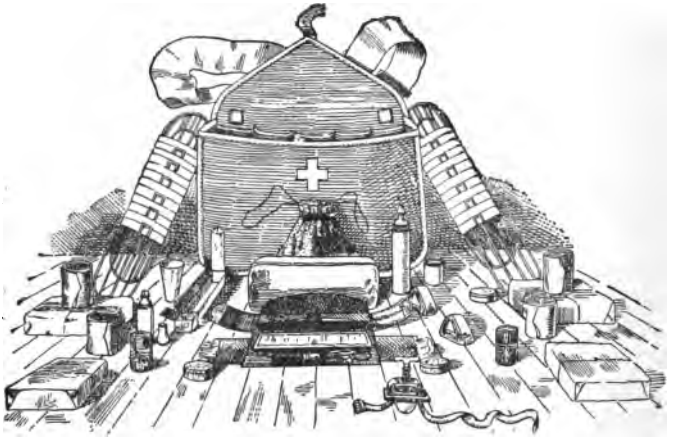


Fig. 141.—Surgical haversack (weight about 5 lbs.) containing bearer's dressing case,* improved; morphia injection (in stoppered bottle and boxwood case), ½ oz.; sal volatile (in stoppered bottle and boxwood case), 2 ozs; graduated horn cup, No. 1; lint, antiseptic, 4 ozs.; loose-wove bandages, antiseptic, No. 4; triangular bandages, antiseptic, No. 6; boric wool, 2 ozs.; isinglass plaster, 12 yards 1-inch tape, 1 tin; plaster, adhesive, 6 yards 1-inch tape, 2 tins; sponges, in waterproof bag, No. 2; identification tallies, 1 book; tourniquets, field, No. 2; tourniquets, screw, small, No. 1; tourniquets, Esmarch's web, No. 2; wax candle and matches, 1 tin box; wire arm splints, with tapes and buckles, 2 pairs.

stretcher is then made over these, as described above, and two extra assistants are required to support the stretcher poles at

* Contents of bearer's dressing case:—Clasp knife, long-bladed; scissors, strong; dressing forceps; spatula, plated; probe and director combined, plated; needles, common, 6; pins, large, 12; skein of thread; half-curved needles, plated, 6; harelip pins, 6; safety pins, 6; sulphuro-chromic gut; skein of worsted; worsted needles, 2; Morocco leather case; water bottle, with drinking cup and strap, complete.

their middle, where they join. No attempt should be made to bind the umbrellas firmly together, as they cannot in that way be made sufficiently secure. The only duty of the two extra bearers is to support by the bandage or handkerchief the jointed middle of the extemporised stretcher poles.

Stretcher Bearers.—There should be four bearers to each stretcher. The bearers standing in their relative positions by the side of a stretcher are numbered from before backwards, as follows:—

No. 1.—At the patient's feet.
No. 2.—Immediately behind No. 1.
No. 4.—Immediately behind No. 2.
No. 3.—At the patient's head.

The arrangement of the bearers is shown in Fig. 140.

The duties of bearers Nos. 1 and 3 are to carry the stretcher as level as possible, and to do so they march slowly, with their knees bent, and with a short 20-inch step. No. 1 moves off with his left foot, No. 3 with his right, so as to prevent the lateral swing, which would take place were they to keep step.

The duties of Nos. 2 and 4 bearers are to look after the general welfare of the patient, to carry the patient's accoutre-

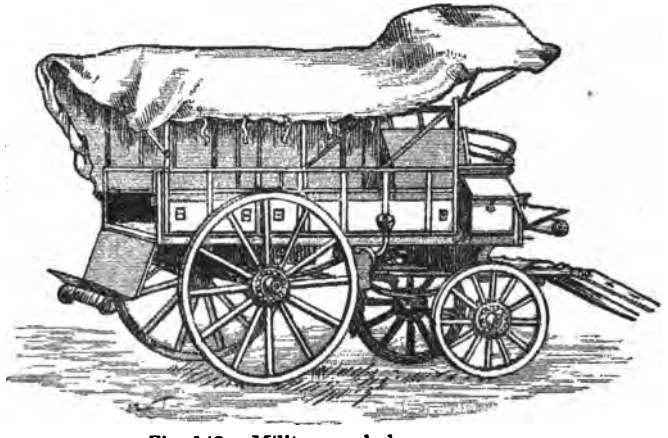


Fig. 142.—Military ambulance waggon.

ments or property, and to render him the necessary first aid treatment. No. 4 is in command of the stretcher squad. If Nos. 1 and 3 become tired, their places are taken by Nos. 2 and 4. The duties of these bearers are further mentioned below

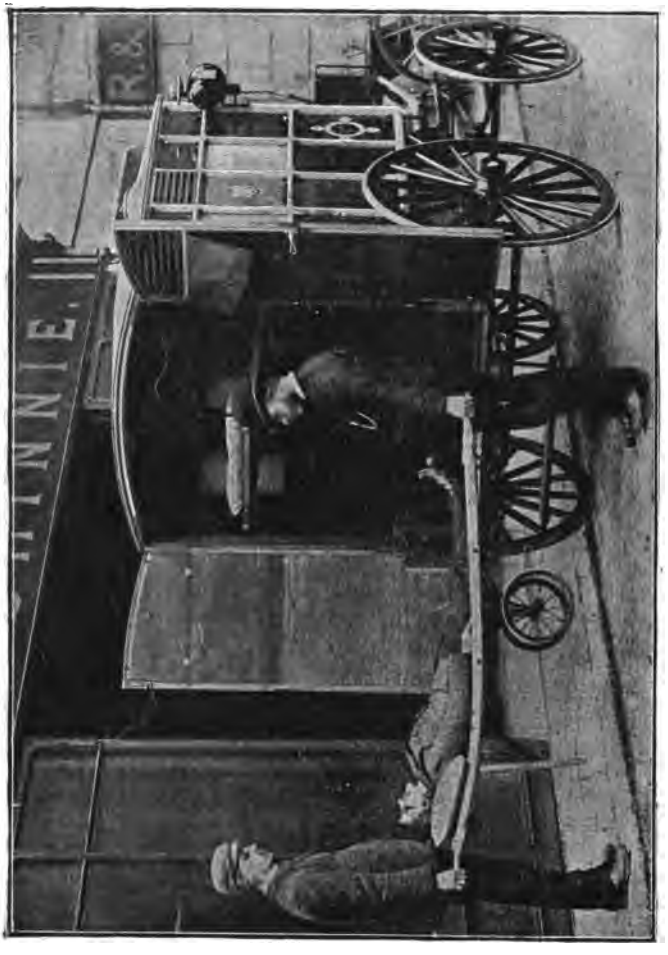


Fig. 143.—Civil ambulance waggon.

under Stretcher Drill (q.v.) In army stretcher drill, the No. 2 bearer is provided with a large water bottle, while the No. 4 carries a surgical haversack, which contains tourniquets, splints, bandages, dressing-case, drugs, &c. Fig. 141 shows the surgical haversack and its contents.

4. **Ambulance Transport.**—(*a*) The *Military Ambulance Waggon* (Fig. 142) is a large, strongly built carriage, with a cover, curtains, and hood of canvas. It is fitted with a corn-locker and water-tank, and is mounted on strong steel springs. It provides accommodation for six or seven wounded men, two inside on stretchers, two on the box in front, and two or three on the tail board behind.

(*b*) The *Civil Ambulance Waggon* is built on the same principle, and is usually fitted to carry three or four patients on stretchers. The ambulance waggons used by the St. John and St. Andrew's Ambulance Associations, and in hospital work, are examples of this form of ambulance transport at its best.

Fig. 143 shows the arrangement of an ambulance waggon made by Messrs. R. & J. Shinnie, Coachbuilders, Aberdeen. This ambulance carriage, which is a model one, has many advantages. The body is hung low, with one step only between floor and ground for easy access with patient. The interior is well lighted with four embossed glass windows, and has a drop lamp from roof, similar to that used in railway carriages, for use at night.

Ventilation is obtained by venetians on each side and in the doors, and can be regulated by closing with hinged covers.

Accommodation is ample for two patients on stretchers. One stretcher can be hung from the roof, there being fixtures at the side and jointed rods from roof which hook the stretcher at each end, every bearing being muffled with rubber and leather to prevent noise. The other stretcher is on india-rubber tyred bicycle wheels, and rolls easily in a tramway grooved way along the floor. At one side folding seats are arranged for three persons, either patients who can sit, or attendants in charge. There is room also for one person beside the driver. The stretcher for suspending is also provided with india-rubber tyred wheels which can be removed if necessary. At the further end inside is a locker for holding splints, instruments, or other surgical appliances. At the front a small window opens for easy communication with the driver.

The springs of the carriage are of finest steel laminated, and with rolled ends, in which are rubber tubes to prevent the possibility of noise being caused by metal rubbing against metal.

The axles are Collinge patent, adapted for smoothness in

running, and the hind axle is cranked down to allow the body to be near the ground.

The wheels are tyred with india-rubber, so that the carriage rides along the roughest roads silently.

A brake to retard the carriage in descending steep roads is worked from the driver's seat.

The stretchers are furnished each with a hair mattress and pillow, and with girth shoulder straps.

Lamps are fixed to sides of the carriage.

The whole carriage is light, easy running, and well finished inside and out.

(*c*) The "*Tortoise*" *Waggon*, the invention of Captain Alfred Savill Tomkins and Surgeon-Colonel Norton, V.M.S.C., consists of a specially fitted ambulance waggon, which carries cooking and hospital equipment. The tortoise hospital tent is carried on the outside of the waggon, as shown in Fig. 144, and if

Fig. 144.—"Tortoise" waggon with "tortoise" tent folded. As a rule the waggon is made to act as a central support for the tent.

desired can be removed from, and pitched without the waggon. This tent is well ventilated, and is lighted by windows in the roof and in the walls, into which light glass frames may be slipped. The "Norton" stretcher bed is used in connection with this waggon. I have seen the "tortoise" waggon and tent in use at Aldershot, and was much impressed with the compact, portable, and complete nature of this field hospital. It is in use in the French and German Army Medical Services.

(*d*) *The Brougham Ambulance.*—In view of the many im-

provements which medical science has effected in the carrying out of measures to meet the increasing demand for more healthful sanitation in populous districts by Hospital Boards and Parochial Authorities, the ambulance brougham may be cited as a most suitable means of transport for persons suffering from injury or infectious disease to suitable institutions for their special treatment.

Those having charge of Belvidere Hospital, Glasgow, have large experience in those conveyances, and have had recently constructed, by Mr. Clark, Coachbuilder, Aberdeen, an ambulance brougham of the most improved pattern, which is a distinct advance on the ordinary cab or carriage used as an ambulance. This ambulance is constructed throughout with special regard to the purpose for which it is intended, and is in every way adapted for the conveyance of accident and fever cases with expedition, and with a minimum of inconvenience to the patient. The room inside is abundant, the doors being extra wide; the light is also subdued, and the greatest ease of motion is obtained; there is perfect ventilation, and all woollen material in the shape of lining, &c., which is likely to hold and communicate the germs of infection is excluded.

In cases of fever in the crowded parts of towns it is impossible to use stretchers in the removal of patients from their houses; they have, therefore, to be carried by the persons removing them. It is then that the convenience of this make of ambulance is felt. As it has a door on each side, the patient can be easily transferred from the attendant's arms through those side doors, and laid gently down on the bed prepared inside to receive him.

This ambulance being also supplied with a large door behind, a loaded stretcher can be pushed in from behind when necessary, there being accommodation between the seats for carrying a patent folding stretcher.

The exterior appearance of the ambulance brougham being so like our street cab (which its name implies) may be driven to a house door without attracting more than the ordinary attention given to any other vehicle, and removes the feeling of disinclination that people often have to entering the ordinary ambulance.

As an inside lining for the ambulance brougham when it is to be used for fever cases, the maker strongly recommends the parchmentised veneer. When this material is varnished it is proof against disease or dirt; it is not affected by any of the ordinary disinfectants; it is much lighter than wood in general; and perfectly noiseless. It is particularly suitable for the trying climates of the east, does not warp or split, and can be made to

any curve or shape. Mr. Clark is, I believe, the first coachbuilder who has applied this material to the purpose of carriage building.

(*e*) An *Extemporised Ambulance Waggon* may be prepared from an ordinary farm cart or lorry. It should have its floor well covered with straw, hay, or bags of chaff, on which the patient is laid. If a stretcher be placed in such a conveyance, it should be firmly lashed to it by ropes to prevent jolting.

A cab will often be of service, but it is *the* worst form of conveyance for a case of fractured leg or thigh. A patient suffering from such an injury should be carried on a stretcher or lorry, if an ambulance waggon cannot be got. Such a patient cannot be lifted into or out of a cab without risk of serious injury.

5. **Cacolets and Litters.**—Wounded men are sometimes carried on mules either on seats (cacolets) fixed to either side of a strong pack saddle, or on beds (litters) similarly attached. These are principally used in guerilla or desert warfare, where it is difficult for waggons to be brought to the scene of action.

Mule cacolets (folded and unfolded) are represented in Fig. 145.

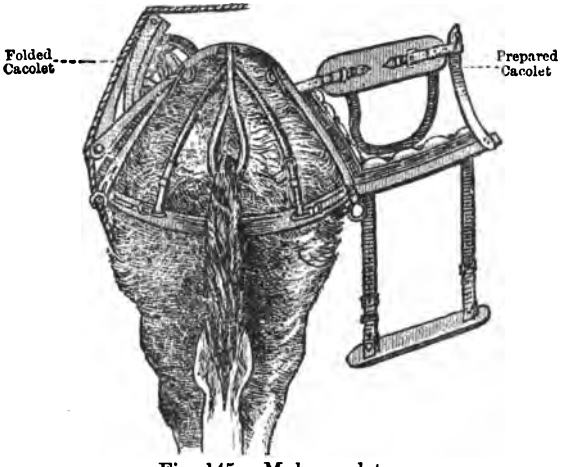


Fig. 145.—Mule cacolets.

Hand litters are occasionally employed, and consist of stretchers fixed on wheels. They are occasionally found of service by the police. Fig. 146 shows the arrangement of a simple hand litter.

Along with litters may fittingly be described the special civil hand ambulances which are now so commonly in use. Fore-

most among these may be mentioned the "Furley-Headley" litter, manufactured hy the Military Equipment Stores and "Tortoise" Tent Company, 61 Pall Mall. This vehicle consists

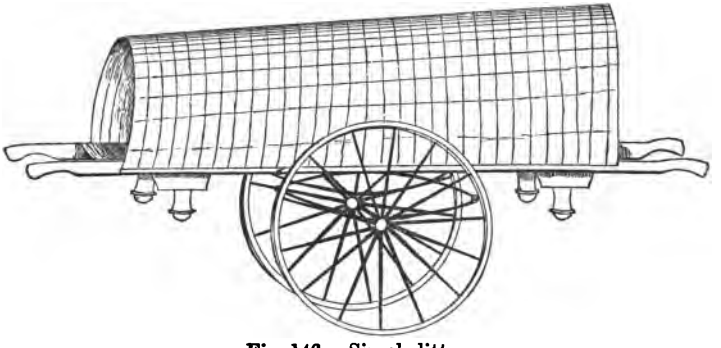


Fig. 146.—Simple litter.

of the "Furley-Headley" stretcher already described (see Fig. 133) and a wheeled carriage. The carriage is supported on two cycle wheels with india-rubber tyres, or, if preferred, on

Fig. 147.—Furley-Headley litter arranged to carry one patient in a recumbent position.

wooden wheels with iron tyres. The stretcher is carried on supports fixed to the springs. The legs of the vehicle are fastened to the axle, and are kept down when the carriage is stationary, or fixed up by small iron stops when it is in motion. The stretcher is supported on the carriage resting on ribbed india-rubber, which prevents slipping. Thus arranged the litter is suitable for the carriage of one patient in the recumbent position (Fig. 147), but when persons slightly injured have to be carried to home or hospital, the litter can be so arranged as to carry one or two patients seated. Poles are then passed through the canvas, leaving the centre of the canvas free. Two supports used for the cover in the recumbent position are brought up in the middle of the litter, and the canvas crossing this forms the back support for the patient, while strips of canvas hung on the poles at either end are used as foot rests (see Fig. 148).

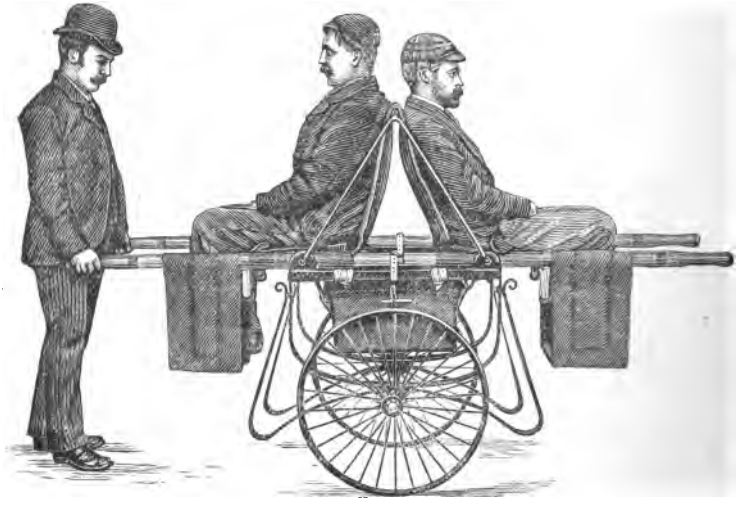


Fig. 148.—Furley-Headley litter arranged to carry two patients seated.

Mr. John Carter, New Cavendish Street, Portland Place, has patented the "Red Cross" ambulance, which is described as the simplest, lightest, easiest, and most perfect three-wheeled ambulance in the market. The carriage is fitted with india-rubber tyred bicycle wheels, and the vibration is almost nil.

Fig. 149*a*.—The Ashford litter en route.

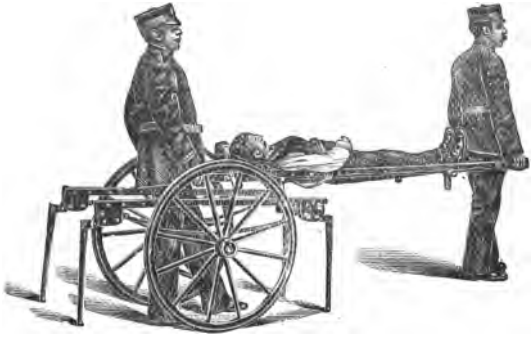


Fig. 149*b*.—The Ashford litter after arrival at depôt.

Fig. 150.—Lowmoor jacket, for use in mines, ships' holds, &c., to secure a patient on a stretcher which can then be placed in an upright position. (See page 145.)

It has a self-guiding front wheel, which is a great advantage in turning sharp corners in hospital corridors. The framework can also readily be taken to pieces and disinfected. The stretcher, which can be folded up for transport like a military stretcher, is raised at the head end to form a pillow, and has a canvas cover. A special advantage claimed for this ambulance is that the stretcher needs only to be placed on the under carriage when it is automatically and instantly fixed without the aid of special catches. It can also be used with great advantage in railway ambulance work, as patients can be wheeled straight into a guard's van without the least disturbance.

The Ashford litter (Figs. 149*a* and 149*b*), which is used by the St. John Ambulance Association, consists of a two-wheeled under-carriage with elliptical springs and a folding cover. By the axle being cranked the stretcher can be carried between the wheels instead of being lifted over them. The litter is light, and can be carried with the patient in it over rough ground. The handles of the litter are used as leg-supports when the litter is at rest.

Military cyclist corps are now so well equipped that they carry with them a bicycle ambulance (see Fig. 151*a*). In the bicycle ambulance the stretcher is carried on safety bicycles, as shown in the woodcut. A patient can be transported in safety, and with great speed and comfort, to the nearest dressing station or field hospital.

6. **Railway Ambulance Waggons.** — If a patient is to travel by rail on a stretcher, the stretcher should be placed in the guard's van, and should lie across the van, being fixed in position by boxes or other articles of luggage to prevent undue oscillation.

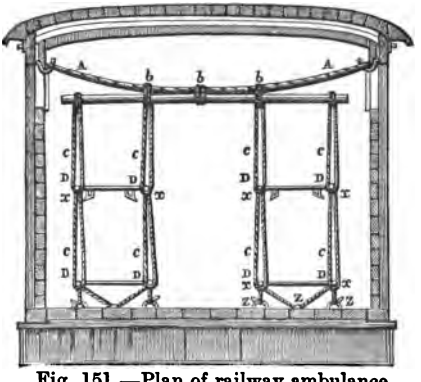


Fig. 151.—Plan of railway ambulance waggon (Zavodovski).

Wounded men may be conveyed, according to Zavodovski's plan, in covered railway trucks by fixing the stretcher poles at their ends in loops of thick rope which swing from the top of the truck, and which help to break the jarring

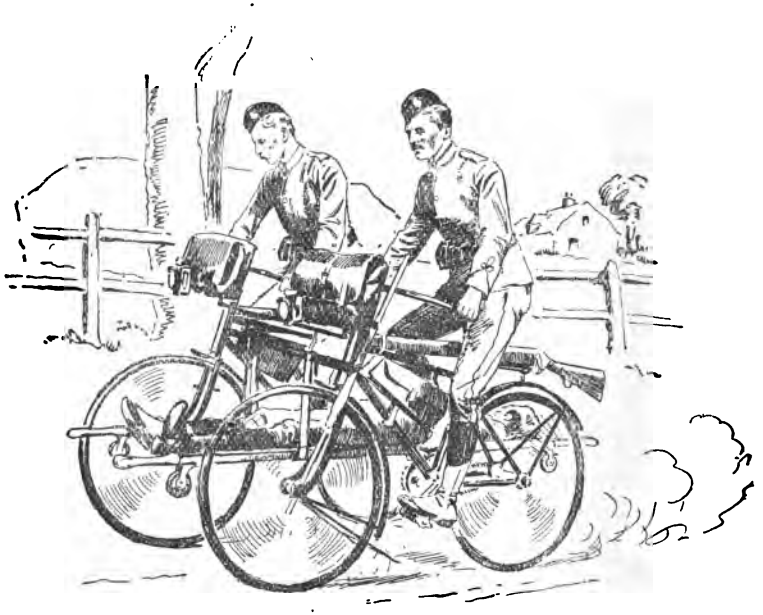


Fig. 151*a*.—The bicycle ambulance.

of the stretcher, as illustrated in Fig. 151, which shows a cross section of such a waggon with the stretchers in position. On some railways, and particularly in the military hospital trains of the Continent, there are regular ambulance railway carriages fitted up like a small hospital ward with every convenience.

STRETCHER DRILL.—To carry out this drill the class should be divided into detachments or squads of four bearers each. These detachments should be drawn up in line, four paces intervening between each. The No. 3 bearer of each detachment should be told off to fetch a stretcher, which he should place to the right of his detachment on its side with the wheels to the right. If there be only one stretcher, each detachment should be put through the drill in succession. Members of the class should be told off to act as patients when they are required. The drill should be carried out at first on the lines laid down in the Medical Staff Corps Drill Book, as quoted below, or in the Drill Book of the St. John Ambulance Association. It may readily be adapted to special classes.

To March with closed Stretchers.—The bearers arranged, as shown in Fig. 140, step off with the left foot, the handles of the stretcher being carried in the right hands of the No. 1 and No. 3 bearers.

To Prepare and Close Stretchers.

"*Prepare Stretchers!*" "*Close Stretchers!*"

Bearers will next be taught the method of preparing stretchers for use, and for this purpose the company having lifted stretchers, will be *extended* at intervals of four paces, and ordered to "*Lower stretchers!*"

On the command "*Prepare stretchers!*" Nos. 1 and 3 of each detachment turn to the right, kneel down on the left knee, unbuckle the transverse straps, and separate the poles, passing a hand under the *traverse*, to make certain of its being perfectly straight. They then arrange the slings on the handles of the poles as follows:—The sling is doubled on itself once, with the tongue of the buckle outside; the loop of the sling is then passed over the near handle and the free ends placed over the opposite handle. The whole then stand up and front, simultaneously, those on the left working by the stretcher detachment on the right, the front rank man of which will give the time by raising his disengaged arm. Nos. 2 and 4 stand fast while this is being done.

"*Close Stretchers!*"—When this order is given, Nos. 1 and 3 of each detachment turn to the right, kneel down on the left knee, remove the slings from the handles, and place them on the

ground beside them. They then bend inwards the jointed *traverse*, and raise the canvas so as to prevent its falling between the poles as these are approximated. As soon as this has been done, Nos. 1 and 3 face each other, and rise, lifting the stretcher between them, and resting the poles between their thighs, with the rollers to the right of the company; they then proceed to roll the canvas tightly round the poles, towards the right of the company, and to spread out the slings evenly on the top of the roll, a transverse strap at either end; the transverse strap is now passed through the loop of the other sling, then round the roll, and buckled off tightly. Nos. 1 and 3 now take hold of the stretcher with the right hand, with the back of their hands to the right of the company, and looking to the right detachment for time they rise erect, and after a slight pause all turn to the front, Nos. 1 and 3 retaining hold of the handles of the stretcher.

To repeat the exercise, the order "*Lower stretchers!*" will be given, and the company then directed to prepare them as before.

The method of marching with folded stretchers is shown in Fig. 140.

To Lift and Lower Prepared Stretchers.

"*Lift Stretchers!*" "*Lower Stretchers!*"

The principal point to be attended to in lifting and lowering prepared stretchers is unity of action on the part of Nos. 1 and 3 bearers of each detachment; No. 3 must be habituated from the first to work simultaneously with No. 1, to wait for No. 1 should the latter not be ready to lift or lower as soon as he is, or to call out "*Stand fast!*" should No. 1 be in advance of him, and then "*Go on!*" when ready. When the men, standing to prepared stretchers, are directed to lift them, it will be done in the following manner, at first by numbers, then judging the time:—

"*Lift Stretchers!*"—Nos. 1 and 3 of each detachment stoop down; each grasps a doubled sling at its centre with the finger and thumb of the right hand, removes it from the handles, and stands up again: they each take a side pace to the right over the pole and close their heels; they then each place a sling over their shoulders, dividing it equally, and with the buckle end over the right shoulder.

"*Two!*"—They stoop, slip the loops of the slings over the ends of the poles, commencing with the left, and then firmly grasp the poles; after a short pause the word "*Three!*" is given by the instructor, upon which Nos. 1 and 3 of each detachment

steadily raise the stretcher off the ground, and stand up holding the stretcher at the full extent of the arms; during the operation No. 3 must closely conform to the movements of No. 1, so that the horizontal position of the stretcher may be maintained throughout.

"*Adjust Slings!*"—No. 2 takes two paces to the front, and Nos. 2 and 4 turn about together. They adjust the slings over the shoulders of Nos. 1 and 3, so that it lies below the collar of the coat behind and in the middle of the shoulders in front. No. 2 takes two paces to the rear, and Nos. 2 and 4 then front together. Directly Nos. 2 and 4 see that Nos. 1 and 3 have stood up, No. 2 takes two paces to his front and turns to the right-about. No. 4 turns to the left-about, and both men then adjust the slings on the neck and shoulders of Nos. 1 and 3 respectively, taking care not only that the sling is well below the level of the collar of the frock, but that it lies accurately in the hollow of the shoulder in front. As soon as these points have been attended to No. 2 returns to his place, and Nos. 2 and 4 front together, the whole working by the right stretcher detachment, which will look to the left of the company and give the time.

"*Lower Stretchers!*"—On the caution "*Lower!*" Nos. 1 and 3 of each detachment prepare to stoop; and on the word "*Stretchers!*" both men lower the stretcher very cautiously on the ground, No. 3 again comforming to the movements of No. 1. They then proceed to slip the loops of the slings off the ends of the poles; stand up, remove the slings from their shoulders, double them, and hold them in the right hand in the manner above described. On the word "*Two!*" Nos. 1 and 3 stand to stretchers, stoop down, arrange the slings on the handles, and stand up again.

To March with Prepared Stretchers.

"*Company by the centre!*" "*Advance!*" "*Retire!*"
"*Right (or left) incline!*" "*Halt!*"

The main purposes to be kept in view in marching with a stretcher are as follows:—Firstly, the mode of progression of the bearers should be so regulated as to avoid any impulse being thereby communicated to the stretcher. This can be best accomplished by the *broken step*, a short pace not exceeding 20 inches, allowing no springing from the fore part of the foot, and by keeping the knees well bent while the advance is being made. And secondly, the stretcher must be maintained on all occasions in the horizontal position, or in a position as near to the horizontal as possible, the inclination downwards, in the latter

case, being towards the feet of the patient, so as to ensure the greatest amount of safety to the person who is being carried upon it. Men of the same height are, therefore, selected to act together as bearers; and, on sloping ground, the general rule for the bearers is, to carry the foot end of the stretcher foremost down hill, but the head end foremost up hill. The exceptions to this rule are mentioned on page 178.

"*Company by the centre!*" "*Advance!*"—The stretchers having been lifted, and the order "*Advance!*" given, No. 4 of each detachment turning outwards at once doubles round in rear of No. 3 to the centre of the opposite pole, and No. 2 steps short two paces, which brings him also to the centre of the stretcher. In the meantime Nos. 1 and 2 and 4 of each detachment step off with the left foot, and No. 3 with the right; all taking a short pace not to exceed 20 inches in length, in quick time, keeping the knees well bent, feet close to the ground, and using the hip joints as little as possible. When ordered to "*Retire!*" or, if retiring, to "*Advance!*" each stretcher detachment will wheel by the right to the rear or front, the No. 3 of the detachment marking time on his own ground until the stretcher is square. At "*Halt!*" Nos. 1 and 3 halt; No. 2 takes a pace to his front; and No. 4, turning outwards, doubles round to his former position on the left of the stretcher.

The *broken step* requires much practice and frequent repetition before the proper carriage of wounded men on stretchers can be secured.

To Load and Unload Stretchers.

"*Take post at the right of the wounded!*" "*Advance!*"
"*Lower stretchers!*"

"*For Loading!*" { "*Lift wounded!*" / "*Lower wounded!*"

"*Lift stretchers!*" "*Advance!*" "*Halt!*" "*Lower stretchers!*"

"*For unloading!*" { "*Lift wounded!*" / "*Lower wounded!*"

To place a patient on a stretcher involves three separate operations, viz.:—

(1) The patient must be lifted off the ground by the bearers of the detachment.

(2) The stretcher must then be laid on the ground immediately under the patient by one of the bearers.

(3) The patient must then be lowered on the stretcher by

Fig. 152.—Stretcher drill—Taking post at right of wounded for loading.

three of the bearers (Nos. 1, 2, and 3), assisted by the fourth (No. 4).

The most essential point in conducting the lifting and laying is **unity of action** on the part of the bearers to whom it is entrusted, including, as it does, the proper distribution of the power (the bearers' hands and arms) under the weight. No. 1 supports the neck and chest; No. 2 the loins and hips; and No. 3 the lower limbs. It must be distinctly understood by the bearers that, although each man is to raise a certain part of the weight of the patient's body, all must act in concert, else the patient's injuries and sufferings may be seriously aggravated by want of attention to this point.

For this exercise, the bearer company, formed in extended order at four paces interval, will prepare stretchers. A party of "dummy" wounded, proportionate to the number of stretcher detachments, and provided with canvas suits to protect their clothing, will now be marched in front of the company and directed to lie down in a row, each patient with his head towards the company, and at about one dozen paces in front of a stretcher.

"*Take post at the right (or left) of the wounded!*" "*Advance!*"—The caution will now be given to the company at which side of the wounded the stretchers are to be placed, which will vary according to the nature of the ground, and this will immediately be followed by the word "*Advance!*" Each stretcher detachment then moves off towards its corresponding patient; having reached his side a halt is made without further word of command (Fig. 152), the No. 4 of the detachment, who is held responsible for the position of the stretcher, turning outwards, and doubling round No. 3 to his place. When lowered, the stretcher should be two paces distant, and in a line with the patient's body. The instructor, when the proper position has been reached, will give the order "*Lower stretchers!*" The stretchers will now be loaded first by numbers, and then judging the time.

"*For loading!*" "*Lift wounded!*"—On receiving this order every detachment moves off as follows:—

If the stretcher has been placed on the *right* of the patient, No. 4 marks time, and Nos. 1, 2, and 3 wheel round by the patient's feet (No. 3 moving outwards to clear No. 4), until No. 1 comes opposite the patient's shoulders, No. 2 opposite the hips, and No. 3 opposite his knees; each man on reaching his place halts, and the whole turn inwards together, No. 4 at the same time placing himself opposite No. 2 (Fig. 153).

If the stretcher has been placed on the *left* of the patient, the detachment will move round by the foot of the stretcher, No. 4

Fig. 153.—Stretcher drill—Lifting wounded for loading.

passing between the stretcher and the patient, Nos. 1, 2, and 3 close round by the patient's feet to the opposite side, halting in the position described; the whole then turn inwards together, No. 4 placing himself opposite No. 2.

"*Two!*"—The whole kneel on one knee (the left if the stretcher has been placed on the right of the patient, and *vice versâ*). The four bearers now proceed to take hold of the patient. No. 1 passes one hand round by the opposite armpit under the patient's shoulder, and the other under the shoulder nearest to him, and he must be careful not to disturb a broken arm; Nos. 2 and 4 pass their hands and arms under the patient's loins and hips, and No. 3 passes both hands under the lower limbs, and in the case of a broken bone, with one hand above and one below the seat of the fracture, in order to support it, and to prevent movement of the ends of the broken bone. As it facilitates the lifting, the patient is now to be directed to clasp his arms round the neck of No. 1 bearer.

At "*Three!*" the detachment, acting as one man, slowly lifts the patient's body about twenty-four inches off the ground, using the knees as a means of support, and steady in that position, the horizontal position of the patient's body being maintained throughout the movement (see Fig. 153).

No. 4 now relinquishes his hold, doubles round by the head of the stretcher to the centre of the pole farthest from the patient, and, taking hold of the near pole with his left hand, and the one farthest from him with his right, lifts the stretcher and places it under the patient close up to the bearers' feet, and then, dropping on the knee, assists in supporting the patient.

"*Lower Wounded!*"—All four bearers will now lower the patient, and place him on the centre of the canvas, in the position best suited to the nature of his wounds, then very gently remove their hands and arms from under him, and stand up, No. 1 or No. 4 of the right detachment, as the case may be, giving the time to the remainder as usual (see Fig. 154).

At "*Two!*" the men stand to stretchers by the shortest way. This will vary with the side of the patient at which the stretcher has been placed in taking post. If at his right side, Nos. 1, 2, and 3 turn to the right, and No. 4 to the left, and all move round to their places, No. 4 marching by the left of No. 3. If at his left side, the whole make a left turn, and Nos. 1, 2, and 3 move round by the head of the stretcher to their places.

The stretchers may now be lifted, and the company practised marching with loaded stretchers (see Fig. 155); after which the company will be halted, and the stretchers lowered, and unloaded, at first by numbers, and then judging the time.

Fig. 154.—Stretcher drill—Lowering wounded for loading.

Fig. 155.—Stretcher-drill—Marching with loaded stretcher.

"*For unloading!*" "*Lift wounded!*"—On this order Nos. 1, 2, and 3 turn to the right, and No. 4 turns outwards and moves round the head of the stretcher to the centre on the opposite side. As soon as No. 4 moves out, No. 3 places himself opposite the patient's shoulders; No. 2 opposite his legs (see Fig. 156).

At "*Two!*" all kneel down and proceed, as before described, to take hold of the patient.

At "*Three!*" he is raised and steadied as before. No. 4 will take hold of the stretcher as before described, lift it off the ground while he is in the stooping position, take two paces back and replace it on the ground, and then, passing round the head of the stretcher, assists Nos. 1, 2, and 3, until the patient is lowered.

"*Lower wounded!*"—The patients will be lowered, and the detachments will stand up. The patients will then be directed to get up, and will be marched to the front again with a view to repeating the exercise or dismissal. As soon as the patients are clear of the detachments, the men will stand to stretchers and front together.

To Load and Unload Stretchers with Reduced Numbers.—*With Three Bearers.*—In the event of there being only three bearers available the stretcher will be placed at the patient's head, and in the same line as his body. The bearers will then lift the patient, rise to the erect position, carry him head foremost over the foot of the stretcher, the horizontal position of his body being maintained throughout the movement, and then place him in a suitable position lying down on the canvas. When unloading, the patient will be lifted and carried head foremost over the head of the stretcher. To lift the patient—one bearer, placing himself on the injured side in a line with the patient's knees, must raise and support the lower limbs; the other bearers raise the body—kneeling down, on opposite sides of the patient near his hips, facing each other, they each pass an arm under his back and under his thighs, and lock their fingers, thus securing a firm grasp preparatory to lifting.

With Two Bearers.—When only two bearers are available, the stretcher will similarly be placed at the patient's head, and in the same line as his body. The bearers will then lift the patient, rise to the erect position, carry him, in loading, head foremost over the foot of the stretcher, and in unloading, head foremost over the head. The method of lifting will vary according to whether the lower limbs are sorely injured or not. (*a*) With a severe injury of one of the lower limbs, both bearers place themselves on the injured side; the one in a line with the

Fig. 156.—Stretcher-drill—Lifting wounded for unloading.

patient's knees must raise and support the lower limbs, the one near the patient's hips the body; assisted by the patient himself as far as possible, the horizontal position of the patient's body being maintained throughout the movement. (*b*) With the lower limbs intact or only slightly injured, the patient may be lifted by one of the improvised seats described on pp. 136 and 140, provided, however, that there are no symptoms of shock present: in the latter case, method (*a*) must be resorted to.

Adapted Stretcher Exercise.—Patients being told off, the detachments, or each detachment in succession, may be put through the following exercise, which should be carried out on the principles detailed above:—

Take post at the right of patient!	*March!*
Lower stretcher!	*Halt!*
For loading, lift patient!	*Lower stretcher!*
Lower patient!	*For unloading, lift patient!*
Lift stretcher!	*Lower patient!*
Adjust slings!	*Fold up stretchers!*

General Rules for the Proper Carriage of Stretchers.—These rules cannot be better laid down than in the words of Professor Sir T. Longmore in his *Treatise on Ambulance*, which are now quoted:—

"(1) When slings are used to assist the bearers in carrying stretchers, care should be taken at starting that they are buckled, so that the parts supporting the poles are all at equal distances from the *surface of the ground.*

"(2) As most ground over which wounded have to be carried is likely to present irregularities of surface, it becomes an important matter for bearers to practise the carriage of stretchers, so as to acquire a facility of keeping the stretcher level, notwithstanding the ground is uneven. Bearers trained and habituated to this duty perform it with ease and dexterity, irrespective of differences in their own respective heights; while those who have not practised it are not unlikely to cause considerable distress to the person carried, when they have to carry him up and down hill, in consequence of their deficient training. A concerted action of the front and rear bearers is necessary, and each must be aware what part he is to perform, according as the end of the stretcher at which he is placed is rendered higher or lower by the unevenness of the surface over which they are passing. The act can readily be acquired by practising the carriage of the stretcher up and down steps. In this practice the front and rear bearers should occasionally change their respective positions. A bearer

should also be carried on the stretcher in turn, so as to be made practically aware of the effects of even and uneven carriage.

"(3) If the ground over which the conveyance has to pass presents a general ascent, and the bearers are of different heights, then the rear or No. 3 bearer should be the taller and stronger man, for his greater height and the greater strength of his arm will be useful in supporting and raising the stretcher up to the level of the end carried by the foremost man. The weight of the stretcher will naturally be thrown in the direction of the man on the lower level.

"(4) If the ground presents a general descent, the front or No. 1 bearer should be the taller and stronger, for the same reasons as those just given as regards the No. 3 bearer under the opposite circumstances mentioned in Rule 3.

"(5) A sick or wounded person on a stretcher should be carried, if the ground be tolerably level, with his face looking towards the direction in which the bearers walk. The front or No. 1 bearer then supports the end of the stretcher at which the patient's feet are placed; the bearer near the patient's head is the rear bearer.

"(6) If the bearers have to carry the stretcher up hill, the leading bearer should support the end of the stretcher on which the patient's head is placed, excepting in the case mentioned under Rule 7. Each bearer will turn to the right about to carry this out.

"(7) If the bearers have to carry the stretcher down hill, the rear, No. 3, bearer should support the end on which the patient's head is placed. The reverse position should be assumed by the bearers, both as regards going up hill and going down hill, in case the patient being carried is suffering from a recent fracture of the thigh or leg.

"The patient's comfort and welfare will be best consulted as a general principle by the arrangements named in Rules 6 and 7. Although under all circumstances the level position should be sought for as much as possible, still, if the slope of the ground be such that it cannot be attained, it appears desirable that the inclination downwards should be towards the feet rather than towards the head of the patient. But with regard to the exception named, the reverse position of the patient is directed, in order to prevent the weight of his body pushing the upper end of the broken bone down upon the helpless and motionless portion of the limb below the seat of fracture.

"(8) No attempt must be made to carry a helpless patient over a high fence or wall if it can possibly be avoided; it is always a dangerous proceeding. The danger is of course increased in proportion to the height of the wall or fence. But even if the

wall be not much higher than one over which the bearers can step, the stretcher must be made to rest upon it, to the inconvenience and probable pain of the patient, while each bearer in succession gets over the obstruction; and it is better even to avoid this inconvenience, provided the avoidance does not entail great delay. If the fence or wall be high, either a portion of the wall should be thrown down, or a breach in the fence made, so that the patient may be carried through on the stretcher; or, if this be not readily practicable, the patient should be carried to a place where a gate or opening does already exist, notwithstanding the distance to be traversed may be increased by the proceeding. It is better that the transportation should be somewhat delayed than the safety of the patient's limbs or life risked.

"(9) In crossing a ditch, dyke, or hollow, the stretcher should be first laid on the ground near its edge. Nos. 1 and 2 then descend. The stretcher with the patient upon it, is afterwards advanced. Nos. 1 and 2 in the ditch supporting the front end of the stretcher, while its other end rests on the edge of the ground above. While thus supported, Nos. 3 and 4 descend. All the Nos. now carry the stretcher to the opposite side, and the fore part now being made to rest on the edge of the ground while the rear part is supported by Nos. 3 and 4 in the ditch, the Nos. 1 and 2 are left free to climb up. The stretcher is now pushed or lifted forward on the ground above, and rests there, while Nos. 3 and 4 climb up. The bearers then carry the stretcher on.

"(10) On no account should a stretcher be carried on the shoulders of two or four bearers. The evil of such a proceeding is not only that it is difficult to find several bearers of precisely the same height, so that a level position may be secured, but also that the wounded or sick person, if he should happen to fall from such a height owing to the helpless condition in which such a patient usually is, is not unlikely to sustain a serious aggravation of the injuries he may be suffering from. Moreover, one of the bearers of a stretcher ought always to have his patient in view, so as to be aware of hæmorrhage, fainting, or other change requiring attention, taking place, and this cannot be done when the patient is carried on the shoulders. The height, too, is calculated to cause the patient uneasiness and fear of falling off, which it is also desirable to avoid. For all these reasons, notwithstanding that bearers will often attempt to carry a patient on a stretcher upon their shoulders, from the weight being borne more easily in that position, or with a view of relieving a fatigued condition of the arms, the practice should be strictly forbidden."

CHAPTER XV.

THE AFTER-TREATMENT OF AMBULANCE CASES.

BED AND BEDDING—THE SICK ROOM—VENTILATION OF THE SICK ROOM—DRESSINGS—WATERPROOFS AND DRAW SHEETS—PATIENT'S TEMPERATURE—APPLICATION OF HEAT AND COLD—CRADLES—BED SORES—ADMINISTRATION OF MEDICINES—OBSERVATION OF THE PATIENT.

No course of ambulance lectures is complete without some account being given of the after-treatment of accident cases. Such treatment usually falls into female hands, and the matter dealt with in this chapter is intended to fill in ladies' ambulance classes the place which is taken in male classes by stretcher drill and ambulance transport.

1. **Bed and Bedding.**—The bed should be placed, if possible, in the centre of the room in which the patient is to lie, so that it may be approached on either side, and be in a suitable position for removal of the patient from the stretcher.

The bed may afterwards be shifted to a more convenient position.

The bed should be prepared for the reception of the patient. A straw mattress is usually the best, and is an essential in the treatment of leg and thigh fractures. No fracture of the thigh or leg can be kept in proper position on a feather bed or other soft mattress into which the limb sinks.

Hot bottles should be placed in the bed.

If shock or collapse be present the bedding should be arranged so that the patient may be laid between blankets.

2. **The Sick Room.**—The patient's own room should be chosen if possible, but if it be an upstairs room, and the patient have to be carried on a stretcher, a room on the ground floor should be chosen. All useless furniture should be removed.

The sick room is best ventilated by raising the lower sash for a few inches, and supporting it by a piece of board which has been made to fill the gap exactly. Ventilation then goes on between the upper and lower sashes without any sensible draught, and the air in the room can in this way be kept sweet and moist (see Fig. 157).

The room should be kept at a temperature of 60° to 65° F.

3. **Dressings, &c.**—For an accident case which requires dressing, the following requisites should have been obtained:—

Basins, hot water (in kettle), cold water (in jug), carbolic acid, cotton wadding, lint, and bandages.

If a fracture have to be "set," suitable splints should be in readiness, previously well padded with cotton wool.

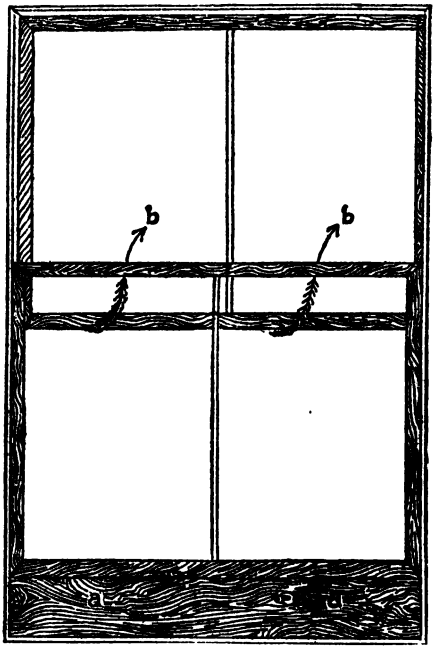


Fig. 157.—Method of ventilating room between upper and lower sashes of window.

The emergency disinfectants and dressing (see under the Antiseptic Treatment of Wounds) may have to be prepared according to the nature of the accident.

If the case be one of poisoning, the emergency emetics and antidotes suitable to the particular case should be at once procured, and laid out neatly on a table in the sick room.

4. **Waterproofs and Draw-sheets.**—Where there is likely to be soakage of blood from a wound, a waterproof or Macintosh

should be placed below the part. If this be not at hand, a "draw-sheet" will do equally well. It is made of a folded bed-sheet placed below the part, and so arranged as to be gradually drawn through as it is soiled, so that a clean part may be brought below the patient while the soiled part is folded up.

5. **Patient's Temperature.** — This should be ascertained every few hours to see if fever be present, and if so, to what extent. In ordinary cases it is taken morning and evening. The temperature is ascertained by the clinical thermometer (see Fig. 158), the bulb of which is placed either in the patient's arm-pit next the skin, in the groin, or in the mouth below the tongue. The latter method should not be used in young children, who may bite and break the glass of the bulb. The thermometer should be left *in situ* from three to five minutes. The level at which the mercury stands in the stem should then be read off and registered on a clinical chart. The arrow at 98·4° indicates the normal temperature of the body in health. A clinical chart may be prepared to show a morning and evening temperature by ruling a piece of paper in the way shown on page 183. The

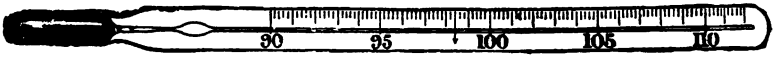


Fig. 158.—Clinical thermometer.

morning and evening temperatures are indicated on the chart by dots, and the dots are then joined by lines. The normal temperature (indicated on the chart by a thick line) is 98·4° Fahr., or 37° Cent. The thermometer should be placed in a vessel containing a little weak carbolic solution, and should have the mercury shaken down to the mark 97° before being again used. Fig. 159 shows the temperature chart from a hospital case of poisoned wound of hand and forearm.

6. **Application of Heat and Cold.**—Heat is applied either by poultices, fomentations, or hot bottles.

Poultices.—Dry poultices consist of a layer of heated cotton wadding applied next the skin and covered by a piece of oiled silk to keep in the heat. They are very suitable for application to parts such as the front of the neck, where the weight of an ordinary poultice is not well borne. Moist poultices are made either of linseed or oatmeal. A linseed or oatmeal poultice is made by adding to boiling water a sufficient quantity of meal to make the poultice thick enough to be spread with a knife, and too thick to run off when laid on a sloping surface.

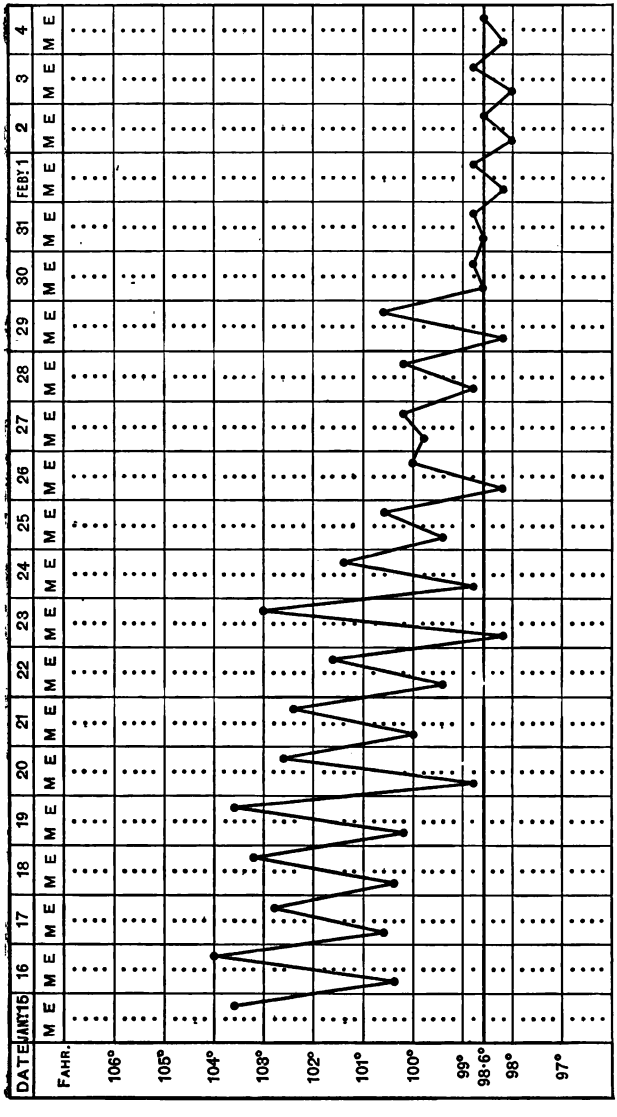


Fig. 159.—Temperature chart of patient suffering from poisoned wound of arm and forearm. The line drawn at 98·6° indicates the temperature regarded by some as that of the body in health. The normal temperature is usually taken as 98·4.

The poultice mixed in a bowl is then spread with a large warm knife or spatula over a handkerchief or piece of flannel, an edge of an inch wide being left all round. This edge is then turned down over the meal so as to leave a square of uncovered poultice surface. The meal surface of the poultice should then be applied next the skin, and to prevent the meal from sticking to the skin a little oil is smeared over its surface before

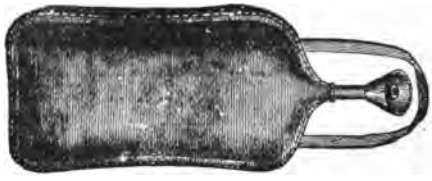


Fig. 160.—Indiarubber hot-water bottle.

application. The heat of the surface should be tested with the back of the hand before being applied to the patient. Such a poultice should be changed about every two hours. If much pain be complained of, as in cases of sprains, a teaspoonful of laudanum may be sprinkled over the face of the poultice.

Fig. 161.—Method of applying cold to head by Leiter's tubes.

Heat may also be applied by fomentations, which are flannel cloths wrung out of very hot water. A fomentation should be covered over with a layer of flannel, or, still better, with waterproof sheeting, to keep in the heat. It should be changed

every fifteen or twenty minutes. If the pain be very great a dessertspoonful of laudanum may be poured over the flannel, as in the case of anodyne poultices. Heat may also be applied with hot bottles. A very serviceable method of applying heat to a joint is to lay over it an indiarubber bottle filled with hot water (see Fig. 160).

Application of Cold. — Cold may be applied in cases of injury to the head by wringing towels out of cold water and applying them over the upper part of the back of the head. They have to be frequently changed. A better method is to procure a bladder and to lay it half filled with ice or cold water on the top of the patient's head.

For the continuous application of cold to the head nothing is better than Leiter's block tin tubes, which fit the head like a cap, and through them a constant stream of cold or iced water is kept circulating. The ordinary way of using these tubes is shown in Fig. 161.

7. **Cradles.**—Cradles are employed to take the weight of the bed-clothes off an injured limb. The ordinary cradle is shown in Fig. 162. A cradle may be extemporised by putting the arm or leg through a hat-box, the end of which has been knocked out. Another way is to support the clothes on a three-legged stool, or to put a gimlet through the bed-clothes and lift them off the part by strings fastened to the gimlet and attached to the top and foot of the bed.

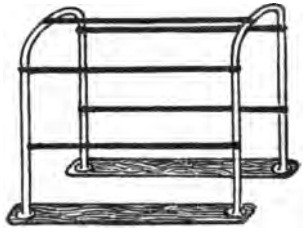


Fig. 162.—Cradle.

8. **Bed-sores.**—Bed-sores occur in debilitated patients on dependent parts pressed on by lying, and particularly over the sacrum, shoulderblade, and outer and upper parts of the thigh. The skin over a part threatening to break out into a bed-sore becomes hot, red, and painful. It should be attended to at once by bathing the part with weak whisky in water, or spirit lotion, and by dusting over it a soft powder like starch, or smearing over it zinc ointment or cold cream. If the skin be already broken, the parts should be washed by warm water and covered by zinc ointment on lint. It has been recommended to cover a bed-sore with a thick batter made of white of egg, flour, and brandy. This dries over the irritated spot and protects it.* An air or water pillow (see Fig. 163) may also have to be procured, and used to diminish the pressure on the irritated and inflamed

* Collodion may be similarly employed.

spot. In bad cases where large bed-sores are present or likely to occur, water-beds are employed.

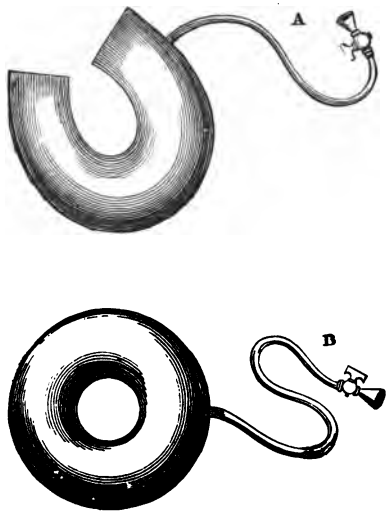


Fig. 163.—Horse-shoe and circular air cushions.

9. **Administration of Medicines.** — Medicines should be given regularly at the time ordered. The following terms are usually employed in directing the dosage :—

♏i.	=	one minim or a drop.	
gr.ī.	=	one grain.	
ʒi.	=	one drachm = one teaspoonful.	
ʒij.	=	two drachms = one dessertspoonful.	
ʒiv.	=	four drachms	= one tablespoonful.
℥ss.	=	half-an-ounce	
ʒviij.	=	eight drachms	= one wineglassful.
℥i.	=	one ounce	

10. **Observation of the Patient.**—It is the duty of the attendant to carefully watch the patient, and to note any change in his condition. Complaints of pain, change of posture, or any particular attitude, sweating, vomiting, rigors, or "shakes," should all be watched for and noted. The amount of sleep, the condition of the tongue, the rate of the pulse, and the amount of fluid and solid nourishment taken in the twenty-four hours should be set down neatly on a special chart prepared for the purpose. Such information is often of great assistance to the medical attendant.

CHAPTER XVI.

ORGANISATION AND MANAGEMENT OF AMBULANCE CLASSES.

(1) Classes conducted under the Auspices of the St. John Ambulance Association, London — Syllabus of Instruction — Syllabus of Instruction on Nursing and Hygiene—Syllabus of Instruction for Junior Classes—Examinations. (2) Classes conducted under the St. Andrew's Ambulance Association, Glasgow—Syllabus of Ambulance Lectures. (3) Classes conducted under the Aberdeen Ambulance Association and Private Ambulance Classes — The Author's Method of dividing the Subjects lectured on, and of arranging the practical work to follow each Lecture — Detailed Account of the Management of Practical Work.

In this chapter the author proposes to furnish information for the starting of ambulance classes under the different ambulance associations. He has also indicated the arrangements which he has found after considerable experience the most suitable for the thorough teaching of practical ambulance work.

I. CLASSES CONDUCTED UNDER THE AUSPICES OF THE ST. JOHN AMBULANCE ASSOCIATION, LONDON.

Where it is intended to form an ambulance class it is usual to call a preliminary meeting, and at this meeting a class secretary and a lecturer are appointed. The class secretary should communicate with the Chief Secretary of the St. John Ambulance Association, St. John's Gate, Clerkenwell, London, E.C., from whom full particulars and copies of the regulations of the Association may be procured. The St. John Ambulance Association course includes three examinations spread over two years. Members of male classes have to pass an examination in First Aid, and two re-examinations in two succeeding years, for each of which a certificate is granted, and after the third examination

the candidate, if he passes, is entitled to the medallion of the Association. Ladies substitute for the first re-examination in First Aid an examination in Nursing. Members of boys' brigades and others too young to join the adult classes are now admitted to junior classes, for which a special course of instructions has been drawn up.

Examination papers in First Aid set by the author for examinations conducted under the auspices of the St. John Ambulance Association are given in the appendix.

A synopsis of the lectures in First Aid, in Nursing, and for junior classes conducted under the St. John Ambulance Association is given below.

SYLLABUS OF INSTRUCTION.

First Lecture.

A. Preliminary remarks, objects of instruction, &c.

B. A general outline of the structure and functions of the human body, including a brief description of the bones, muscles, arteries, and veins. The functions of the circulation, respiration, and of the nervous system.

C. The triangular bandage, and its application.

Second Lecture.

A. The general direction of the main arteries, indicating the points where the circulation may be arrested by digital pressure, or by the application of a tourniquet.

B. The difference between arterial, venous, and capillary bleeding, and the various extemporary means of arresting it.

C. The triangular bandage.

Third Lecture.

A. The signs of fracture, and first aid to be rendered in such accidents. The application of splints, or other restraining apparatus. Treatment of sprains.

B. The triangular bandage.

Fourth Lecture.

A. First aid to those suffering from collapse from injury; to those stunned; to the apoplectic, inebriated, epileptic, fainting, and to those bitten by rabid animals.

B. The immediate treatment of the apparently drowned, or otherwise suffocated.

C. Burns, scalds, and poisons. What to do when dress catches fire.

Fifth Lecture (for males only).

A. The improvised method of lifting and carrying the sick or injured.
B. Methods of lifting and carrying the sick or injured on stretchers.
C. The conveyance of such by rail or in country carts.

Fifth Lecture (for females only).

N.B.—This lecture will be in accordance with the special chapter inserted in Shepherd's handbook, August, 1890.

Note I.—The subject of poisons should be treated in a general manner. The common poisons classified, and only their general symptoms and effects taught.

With regard to the treatment, the first indications, viz., how to get rid of the poison is the only one which can be safely practised by non-professional persons. The administration of antidotes is the medical man's duty.

Note II.—The last half hour of each lecture should be devoted to practical work, such as the application of bandages and splints, lifting wounded, and carrying on stretchers.

Note III.—There should be an interval of a week between each lecture. A candidate for examination must attend at *least* four out of the five lectures.

Mixed classes of men and women are on no account permitted.

Full particulars as to the work of the Association can be obtained from the Chief Secretary, St. John's Gate, Clerkenwell, London, E.C.

SYLLABUS OF LECTURES ON NURSING AND HYGIENE.

Lecture I.

The Sick Room.—Introductory remarks—Selection, preparation, and cleaning of room—Bed and bedding—Furnishing—Warming and ventilation.

The roller bandage, and its application.

Lecture II.

Infection and Disinfection.—Infectious and non-infectious cases—Quarantine of patient—History of a fever case—Disinfecting and disinfectants.

The roller bandage, and its application.

Lecture III.

Details of Nursing.—The nurse—Regulation of visitors—Management of nurse's own health—Washing and dressing patients—Bed-making—Changing sheets—Lifting helpless patients—Sick diet—Administration of food, medicines, and stimulants.

The roller bandage, and its application.

Lecture IV.

Details of Nursing (*continued*).—Observation of the sick—Rigors—Sleep—Pain—Posture—Skin—Appetite—Vomiting—Cough—Expectoration—Effects of remedies, &c.—Temperature taking—Baths—Bed-sores—Delirium—Nursing sick children—What to prepare for physician's and surgeon's visits.

The roller bandage, and its application.

Lecture V.

Application of Local Remedies.—Poultices—Fomentations—Blisters—Ointment—Leeches—Padding splints—Bandaging—Personal and family hygiene, including house drainage—Management of convalescents.

N.B.—Except under special circumstances no person is allowed to enter for examination in these subjects, without having obtained the certificate of "first aid to the injured." The pupil must also have attended at least four out of the five lectures.

The nursing course can be commenced as soon as the result of the first aid examination is published, and those pupils who pass the examination can count the same as equivalent to the *first re-examination* towards the medallion.

SYLLABUS OF INSTRUCTION FOR JUNIOR CLASSES.

A short description of the bones, muscles, and arteries.

Uses of the circulation and respiration.

Difference between arterial, venous, and capillary bleeding, and methods for stopping each.

Position of main arteries.

Signs of a broken bone, and methods of treatment.

Making temporary splints.

How to treat persons in fits, fainting, scalded or burned, or whose clothes are on fire.

How to treat the apparently drowned or suffocated.

Ways of carrying an injured person.

Mode of using the triangular bandage.

For Females only.

How to prepare a room for a sick person, and to ventilate it and heat it.

How to prepare the bed for a sick person, and to change the sheets.

Washing and dressing a sick person.

Dressing wounds—making and applying poultices and ointments.

The proper way of feeding sick persons and children.

Hints on giving medicines to patients.

Applying the roller bandage to leg and arm.

Note I.—The number of lectures into which this syllabus may be divided, and the method of sub-division, are left to the discretion of the lecturer, but he must not give less than six lectures.

Note II.—The application of bandages should be practised at the end of each lecture. At the end of the course an examination will be held, which

will be of a thoroughly practical character, and will be conducted by an examiner other than the lecturer, as in the case of other classes.

Note III. — Mixed classes of both sexes are not allowed; and the lecturer must of course be a properly qualified medical practitioner, as usual.

Examinations.

The local secretary should provide the following material:—

(*a*) *Men's Classes.*—A good supply of bandages, material for temporary splinting, and a stretcher.

(*b*) *Women's Classes* (*First Aid*).—A good supply of bandages, material for temporary splinting, and, if practicable, two boys, who have not acted as models during the lectures, for every ten candidates.

(*c*) *Nursing Classes.*—A good supply of roller and triangular bandages, and material for making poultices, a bedstead or couch with bedding or sheets, two boys for every ten candidates. It is desirable that different boys as models should attend at the examination, as cases have not infrequently been noticed where the models have given information (erroneous or otherwise) to candidates.

Pens, ink (or pencils), and paper.

A list of candidates, with christian and surname, should be given to the examiner.

The number of candidates to be examined at one time should not exceed thirty.

Two rooms should be provided whenever possible.

The examination shall be written and practical, but the examiner may omit the written part, if the local secretary give to the examiner satisfactory reasons in writing three days before the date of the examination.

No candidate who is unable to pass in the practical part shall receive a certificate.

No candidate who has failed shall be allowed to present himself or herself at another examination without attending a fresh course of lectures.

Candidates will be examined practically in the following Subjects:—

"**First Aid Classes.**"—The neat and quick application of the triangular bandage to any part of the body.

The arrest of hæmorrhage by pressure of the fingers on the main arteries of the limbs.

The application of splints and bandages for any fracture. Performing artificial respiration.

Improvising stretchers,
Placing patients upon stretchers,
Carrying stretchers,
Carrying patients without stretchers,
} For male classes only.

Male classes must pass in that system in the "*Stretcher Exercises*" most suited to the locality. Lecturers are requested to bear in mind the necessity of instruction in this subject, as ignorance hereon will result in failure in the examination. (These exercises are included in Shepherd's handbook.)

"**Nursing Classes.**"—The neat and quick application of the triangular bandage to any part of the body, and as regards the roller bandage, to the following parts:—thumb, hand, arm, elbow, foot (including heel), ankle,

leg, figure-of-eight to knee joint, spica for the shoulder and hip, the breast, capelline, and the four-tailed bandage for the jaw.

Reading ordinary bath and clinical thermometers.

Recording patient's temperature.

Making poultices.

Changing sheets.

Lifting patient for food, &c., or on and off the bed.

In both classes the written examination shall consist of questions on subjects mentioned in the syllabus of lectures.

II. CLASSES CONDUCTED UNDER THE ST. ANDREW'S AMBULANCE ASSOCIATION, GLASGOW.

Secretaries of Scotch classes to be held under the St. Andrew's Ambulance Association, Glasgow, should communicate with the Secretary, 103 West Regent Street, Glasgow.

SYLLABUS OF AMBULANCE LECTURES.

First Lecture.

A. Introductory remarks, explaining clearly the scope and object of lay help in ambulance work, special attention being drawn to the need of it, as well as the usefulness and simplicity of it.

B. Short sketch of the general anatomy of the human body, including a brief description of the functions of digestion, absorption, circulation, respiration, excretion, secretion, and innervation.

C. Uses of a bandage—Of the two kinds of bandages, the roller not needed for ambulance work—Description of Esmarch's triangular bandage, pointing out (1) its advantages, (2) method of folding and fastening it, (3) its application in different ways—Hints as to the "first dressing" of wounds by ambulance pupils.

Second Lecture.

A. Short account of the skeleton, with brief description of the structure and varieties of the joints.

B. (1) *Fractures.*—Their varieties, causes, symptoms, and dangers—Their temporary treatment, and the apparatus necessary for it. (2) *Dislocations.*—How they differ from fractures, and the first aid in such cases—No necessity for immediate reduction, and the dangers of attempted reduction by non-professional persons.

C. Illustrations of the temporary treatment of the following *simple* fractures:—(1) Collar bone, (2) upper arm, (3) forearm, (4) hand, (5) thigh, (6) leg, (7) foot, (8) lower jaw.

Third Lecture.

To be devoted to practical work, when the members of the class will exercise themselves in the use of the triangular bandage and the temporary treatment of the different fractures mentioned in the previous lecture.

Fourth Lecture.

A. (1) General description of the circulation of the blood, and the mechanism by which it is carried on—(2) Distinction between arterial, venous, and capillary hæmorrhage—(3) Names of the main arteries of the body, with their situations—(4) Points where arterial circulation may be arrested by pressure—(5) Dangers of hæmorrhage.

B. General treatment of hæmorrhage:—I. *Internal hæmorrhage*—First aid in cases of (1) bleeding from the nose, (2) spitting of blood, (3) vomiting of blood. II. *External hæmorrhage*—(1) Application of cold, either by water or exposure to air—(2) Elevation of part—(3) Local pressure—(4) Distant pressure on main artery supplying wound, either by hand or tourniquet—(5) Three kinds of tourniquet: elastic, screw, and improvised.

C. Show mode of applying elastic or screw tourniquet, and of making an improvised one—Give illustrations of arrest of hæmorrhage from (1) scalp, (2) neck, (3) armpit, (4) upper arm, (5) forearm, (6) hand, (7) thigh, (8) ham, (9) leg, (10) foot—Give illustrations of temporary treatment of a *compound* fracture, with hæmorrhage in upper or lower extremity.

Fifth Lecture.

To be devoted to practical work, when the members of the class will exercise themselves in the arrest of hæmorrhage in various situations, and in the temporary treatment of *compound* fractures.

Sixth Lecture.

A. Short account of respiration, its objects and mechanism.

B. Fainting, its causes, symptoms, and treatment—Immediate treatment of those apparently drowned, or suffocated by (1) hanging, (2) poisonous gases, (3) choking—First aid in cases of (1) burns and scalds, (2) bites by animals possibly rabid, (3) tears from machinery, (4) crushed and bruised parts, (5) stabs.

C. Show mode of performing artificial respiration (Sylvester's method), and also the temporary treatment of fractured ribs.

Seventh Lecture.

To be devoted to practical work, when the members will exercise themselves in performing artificial respiration, and in the arrest of hæmorrhage from supposed cases of ruptured varicose veins, stabs, tears from machinery, and gunshot wounds.

Eighth Lecture.

A. Short account of the nervous and digestive systems.

B. Symptoms and first treatment of shock or collapse.

C. First aid in cases of (1) those stunned by a fall or injury to head, (2) convulsions, (3) epilepsy, (4) sunstroke (5) persons found insensible, (6) suspected poisoning, (7) frost-bite, (8) lime in the eye, (9) supposed death.

Ninth Lecture.

A. Removal of the injured by means of stretchers, special attention being directed to (1) the proper carriage of the stretcher, (2) the manner of placing it, (3) the loading and unloading it, (4) the position of the patient on it, (5) suggestions as to overcoming difficulties on the road, (6) hints as to the conveyance of stretchers by rail or country carts.

B. Short account of some of the improvised methods of removing injured persons when no stretchers or regular conveyances are available, as by the two-handed, three-handed, and four-handed seats.

C. Give illustrations as to how to prepare and fold up a stretcher.

Tenth Lecture.

Stretcher drill in presence of and under direction of lecturer.

III. CLASSES CONDUCTED UNDER THE ABERDEEN AMBULANCE ASSOCIATION AND UNATTACHED AMBULANCE CLASSES.

The Secretary of the Aberdeen Ambulance Association is Mr. William Smith, Advocate, 201 Union Street, Aberdeen. The text-book commonly used is the Author's *Manual of Ambulance*. The arrangement which the author has found most convenient for lectures and practical work is detailed below.

Lecture I.

(1) Outlines of the anatomy and physiology of the human body, omitting the sections dealing with circulation and respiration, which are taken up under hæmorrhage and suffocation respectively.

(2) The triangular bandage and its uses.

Practical Work to follow Lecture I. - At the end of Lecture I. the student should examine carefully the specimens on the lecture table. A meeting for practical work should be held either immediately after the lecture, or, what is preferable, at a special meeting set apart for it to be held at an hour before the succeeding lecture. At the practical meeting following the first lecture the student should have demonstrated to him the different parts of the skeleton, should handle the individual bones and make himself familiar with their shape and names. He should also have pointed out to him the position of the diaphragm, the position of the more important organs of the abdomen and thorax, the interior of the skull, and the position of the brain and spinal cord.

After such demonstration, which may be conducted by the lecturer alone or with trained assistants, the student should be practically instructed in the application of the triangular bandage. In a small class each student should be provided with a live model, and boys can generally be procured

for that purpose. In a large class the best arrangement is to divide the class into two sections, which should face each other in two lines, each line alternately acting as models.

The lecturer or his assistant should, in the first case, go over the bandages in the same order as in the lecture, and in the first application, the description of the special bandage the student is to practise should be read to him slowly, he at the same time following the description point by point in his bandaging. When more proficient he should be asked to apply in quick succession the different bandages, no aid being given to him by description or otherwise. The lecturer should, after the application of each bandage, pass along the lines and make an examination, the mistakes in application being pointed out. The student should also be instructed to practise at home the application of the bandage, and in that way proficiency will soon be attained.

Lecture II.

Fractures, dislocations, and sprains, and their treatment.

Practical Work to follow Lecture II.—The student, at the second practical meeting, should be again instructed in the application of the triangular bandage. He should also examine the specimens of fracture, and the various forms of extemporised splints shown at the preceding lecture. He should then have demonstrated to him the method of applying splints to the more important fractures, and should himself "put up" such fractures as the instructor may choose, and particularly those of the collar bone, arm, forearm, leg, and thigh. If time permit, he should be examined orally on the kinds, symptoms, and treatment of fractures.

Lecture III.

(1) The circulation of the blood and the anatomy of the main blood-vessels.

(2) Hæmorrhage and wounds, and their treatment.

Practical Work to follow Lecture III.—The classes should be provided with live models, and divided into two sections as before. The student should be asked to apply the important triangular bandages, and to "put up" the more important fractures. He should then have demonstrated to him the position of the main blood-vessels of the body, and should be asked to point out their position on his model *vis-à-vis*.

Digital compression and application of the tourniquet for the arrest of arterial hæmorrhage should next be practised. The lesson should conclude with a demonstration of the method of arresting hæmorrhage from the large superficial veins.

Lecture IV.

(1) Drowning and suffocation, and their treatments; (2) poisoning; (3) burns; and (4) removal of foreign bodies from the eye, ear, nose, throat, and tissues.

Practical Work to follow Lecture IV.—The student should again be taken over the lines of the main vessels of the body, and should practise the application of digital pressure, and of the tourniquet to the large arteries.

Each student should then be afforded an opportunity of practising on a model Sylvester's method of artificial respiration. He should then be examined orally on the symptoms and treatment of the important poisons, and in the method of removal of foreign bodies from the eye, ear, &c.

Lecture V.

(1) Insensibility and fits, and their treatment; (2) ambulance transport (for males only); (3) after treatment of ambulance cases (for females only).

Practical Work to follow Lecture V.—The female section of the class should devote their last meeting to the practice of bandaging. The male section of the class should have one or two hours stretcher drill.

In addition to the above lectures and demonstrations of practical work, oral examinations may be given during the course, and form a good means of preparation for the candidate before examination. The candidate should also be asked to do one of the written papers in the Appendix.

EXAMINATION PAPERS IN FIRST AID.

PAPER I.

Time—One Hour and a half.

I. Describe generally the circulation of the blood. How would you distinguish venous, arterial, and capillary hæmorrhage?

II. How would you distinguish between the following:—

(*a*) A fainting fit and an epileptic fit?
(*b*) A simple and compound fracture?
(*c*) Apoplexy and alcoholism?

III. State shortly the proper treatment for the following conditions:—

(*a*) Broken collar bone.
(*b*) Stab wound of artery of armpit.
(*c*) Poisoning by opium.
(*d*) An apoplectic seizure.

IV. What are the differences between inspired and expired air? Describe a method of artificial respiration.

V. Poisoning by oil of vitriol. To what class of poisons does this belong? Give its signs and "first aid" treatment.

PAPER II.

Time—Two Hours.

I. Mention the more common materials to be found in any house that you might find it necessary to ask for in applying first aid to

(*a*) A case of bad scalding.
(*b*) A fracture of forearm.
(*c*) A compound fracture of the thigh.
(*d*) A case of poisoning by opium.
(*e*) A case of poisoning by vitriol.

II. How would you recognise and treat respectively:—

(*a*) A fainting fit?
(*b*) An epileptic fit?
(*c*) An attack of apoplexy?

III. The driver of a traction engine has fallen from his seat, and has had his left leg run over by the waggon behind the engine. You have been a witness of the accident, which has occurred on a lonely country road. Enumerate in order the points to be attended to:—

(*a*) In ascertaining the nature of his injuries.
(*b*) In treating the same.
(*c*) In removing him from the scene of the accident to his own home.

IV. Bleeding from an artery. State :—
(*a*) Its characteristics.
(*b*) Its treatment.
(*c*) The lines of the main arteries of the upper and lower extremities, and the methods of their compression.

V. What special cares would you take in carrying downhill on a stretcher a patient suffering from
(*a*) Apoplexy?
(*b*) A fainting fit?
(*c*) A simple fracture of the thigh?

Practical examination follows.

PAPER III.

Time—Two Hours.

I. How would you check bleeding
(*a*) From an artery in the upper part of thigh?
(*b*) From an artery at the wrist?
(*c*) From an artery in the armpit?
(*d*) From a burst varicose vein of leg?

II. You are called to render first aid to a person found lying unconscious, state briefly:—
(*a*) The possible causes of the insensibility.
(*b*) How you would distinguish between them.
(*c*) The treatment of each condition.

III. In a case of compound fracture of both leg bones (tibia and fibula), state :—
(*a*) The special dangers of the accident, and the methods of their prevention and treatment.
(*b*) How would you render first aid?
(*c*) The precautions you would observe in getting the patient carried downhill on a stretcher.

IV. How would you set about resuscitating a boy who has fallen from a boat into deep water, has been in the water five minutes, and is quite unconscious when rescued, but whose heart is still beating?

V. State what you know about the following :—
(*a*) Comminuted fracture.
(*b*) Tourniquet.
(*c*) Femur.
(*d*) Temporal artery.
(*e*) Pinhole pupil.
(*f*) Antidote.
(*g*) Diaphragm.
(*h*) Pulmonary artery.
(*i*) Crepitus.

VI. Detail the methods of improvising a stretcher, and the instructions you would give to four men (not trained in first aid methods) as to the lifting, carrying, and laying down of a patient with fractured thigh on such a stretcher.

Ladies will substitute the following for question VI. :—

VI. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a stab wound of main artery of thigh).

Practical examination follows.

PAPER IV.

Time—One Hour and a half.

I. How would you render first aid to
(*a*) A man with a broken collar bone?
(*b*) A man bleeding from a stab through the main artery of the thigh?
(*c*) A lady who has fainted in church?
(*d*) A man seized with a fit of apoplexy in the street?
(*e*) A boy scalded through his dress with boiling water?

II. Distinguish bleeding from an artery from bleeding from a vein. How would you treat each?

III. How would you set about resuscitating a boy who has fallen from a boat into deep water, has been in the water five minutes, and is quite unconscious when rescued, but whose heart is still beating?

IV. How would you make sure that a bone has been broken? What is the difference between a simple and compound fracture?

Practical examination follows.

PAPER V.

Time—One Hour and a half.

I. What are the different varieties of bleeding? Give the treatment of each.

II. Detail the method of rendering "first aid" to a boy scalded through his stocking with boiling water.

III. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a compound fracture of the thigh, where an amputation may have to be done).

IV. How would you distinguish a fainting from an epileptic fit, and drunkenness from an attack of apoplexy? Give the treatment of each.

V. State what you know about the following:—
(*a*) Tourniquet.
(*b*) Diaphragm.
(*c*) Femur.
(*d*) Pinhole pupil.
(*e*) Dislocation.
(*f*) Sylvester's method of artificial respiration.
(*g*) Pulmonary artery.
(*h*) Normal temperature of body, and the proper temperature of a sick room.

VI. How would you distinguish a dislocation from a fracture near the joint?

Oral and practical examination follows.

PAPER VI.

I. In a case of compound fracture of the tibia state
(*a*) The special dangers of the accident.
(*b*) How would you render "first aid?"
(*c*) The precautions you would observe in carrying the patient downhill on a stretcher.

II. What are the varieties of bleeding, their characteristics, and their treatment?

III. Describe *in detail* a method of performing artificial respiration.

IV. State shortly the proper treatment for the following conditions:—
(*a*) Broken collar bone.
(*b*) Stab wound of artery of armpit.
(*c*) Poisoning by opium.
(*d*) An apoplectic seizure.

V. What are the main points to attend to in carrying a patient on a stretcher? Describe how to improvise a stretcher.

Oral and practical examination follows.

PAPER VII.

I. State briefly what you know about the following:—
(*a*) Arterial bleeding.
(*b*) Tourniquet.
(*c*) Brain and nerves.
(*d*) Diaphragm.
(*e*) Tibia.
(*f*) Function of respiration.
(*g*) Pinhole pupil.
(*h*) Sylvester's method of artificial respiration.
(*i*) Capillary.
(*j*) Pulmonary artery.

II. How would you distinguish between the following:—
(*a*) A fainting fit and an epileptic fit?
(*b*) A simple and compound fracture?
(*c*) Venous and capillary bleeding?
(*d*) Apoplexy and alcoholism?

III. Give the "first aid" treatment for
(*a*) A large scald of back.
(*b*) Poisoning by laudanum.
(*c*) Poisoning by strong nitric acid.
(*d*) Fracture of lower jaw.
(*e*) A bite of leg (dog rabid).
(*f*) Fracture of thigh bone.

IV. Give an account of the improvised method of lifting and carrying the sick and injured.

Oral and practical examination follows.

PAPER VIII.

Time—One Hour and a half.

I. In the case of compound fracture of both leg bones (tibia and fibula), state

(*a*) The special dangers of the accident.
(*b*) How you would render "first aid."
(*c*) The precautions you would observe in carrying the patient downhill on a stretcher.

II. How would you check bleeding

(*a*) From an artery in the foot?
(*b*) From an artery in the upper part of the thigh?
(*c*) From an artery at the wrist?
(*d*) From an artery at the armpit?
(*e*) From a burst varicose vein of leg?

III. In the case of a person becoming suddenly unconscious, state briefly

(*a*) The possible causes.
(*b*) The points of distinction.
(*c*) The treatment of each.

IV. Detail the method of rendering "first aid" to a boy scalded through his stocking with boiling water.

V. Describe in detail a method of performing artificial respiration.

Practical examination follows.

PAPER IX.

Time—Two Hours.

I. Bleeding—

Describe the treatment of bleeding:—

(*a*) From the artery of the armpit.
(*b*) From an artery in the palm of the hand.
(*c*) From the temporal artery.
(*d*) From a burst varicose vein of leg.

II. Broken collar bone—

(1) How is this injury recognised?
(2) How would you render "first aid"?

III. Artificial respiration—

(1) Describe fully a method of performing artificial respiration.
(2) For what conditions has artificial respiration to be performed?

IV. State what you know about the choice and preparation of a room and bed for the reception of an accident case (a fracture of the thigh).

V. Enumerate some of the more common extemporised splints which might be used in the treatment of a fractured forearm, and describe the method of their application.

VI. How would you distinguish a fainting from an epileptic fit? Give the treatment of each.

Only five questions to be answered.

PAPER X.

Written Examination.

I. Describe and distinguish between
(*a*) The different kinds of fracture.
(*b*) The different forms of fits causing insensibility.
(*c*) The different varieties of bleeding.

II. Describe fully the method you would adopt to resuscitate a person apparently drowned.

III. Give the "first aid" treatment for
(*a*) A compound fracture of thigh.
(*b*) Poisoning by laudanum.
(*c*) Insensibility and intoxication.
(*d*) Fracture of skull.
(*e*) Extensive scald of forearm.
(*f*) Bleeding from radial artery at wrist.

IV. How would you prepare a bed for the reception of a case of fractured thigh?

PAPER XI.

Final Examination.

I. Describe the course of the blood from the time it leaves the right ventricle of the heart till it reaches the palm of the hand.

II. In the following cases explain
(*a*) What the patient is suffering from.
(*b*) The methods by which you may render "first aid."

(1) A young lady suddenly becomes unconscious in a tramway car. There is extreme pallor of the face and lips, and the pulse can hardly be felt. There are no other symptoms save that before becoming unconscious she complains of feeling giddy and out of sorts.

(2) A servant, in dusting the top of a book-case, fell to the ground with her left leg doubled below her. On examination you find the leg to be quite helpless. There is distinct crepitus and marked deformity, and a small portion of the tibia is protruding through the skin.

(3) A young servant girl, fresh from the country, is found unconscious in her bedroom in the early morning. Gas has evidently been escaping in the room for some hours. She is flushed, with a pulse of 90, and her respirations are 28 per minute.

III. State what you know about the following:—
(*a*) The normal temperature of the human body.
(*b*) The treatment for poisoning by opium.
(*c*) The treatment for a dog bite (the dog supposed to be rabid).
(*d*) The different kinds of nerves.
(*e*) The treatment for bleeding from the main artery of the arm and leg respectively.

Oral and practical examination follows.

PAPER XII.

I. What is the arrangement of the bones forming the chest? What dangers may arise from a fractured rib?

II. Name and give the arrangement of the bones of the lower limb (omitting the bones of the foot). What treatment would you adopt in the case of compound fracture of the leg bones?

III. Describe generally the circulation of the blood. How would you distinguish venous, arterial, and capillary hæmorrhage?

IV. Describe Sylvester's method of artificial respiration. What after treatment would you adopt in a case of apparent drowning?

V. (*a*) What methods would you adopt to control severe hæmorrhage due to a wound in the palm of the hand?

(*b*) At what points would you apply digital compression for hæmorrhage of the femoral artery, the radial artery, and the facial artery? What is the general principle involved?

VI. What treatment would you adopt in

(*a*) An apoplectic fit?
(*b*) An ordinary fainting fit?
(*c*) A poisoned bite?
(*d*) A case of scalding?

PAPER XIII.

I. What is a splint, and for what purpose is it used? Mention the different forms of emergency splints.

II. What "first aid" assistance would you render in the case of a man found insensible in a room full of smoke?

III. What are the most dangerous forms of fracture and of hæmorrhage? Give reasons for your answer.

IV. Give the treatment for a case of cut-throat.

V. What is shock? What are the appearances seen in this condition? What is its treatment?

PAPER XIV.

I. Give the treatment for a wound in the sole of the foot with considerable arterial hæmorrhage.

II. Define an emetic, and state the simple emetics which are usually at hand.

III. Give the "first aid" treatment for

(*a*) A fracture of the forearm.
(*b*) A fractured collar bone.
(*c*) Poisoning by opium.

IV. What are the differences between inspired and expired air? Describe a method of artificial respiration.

V. What kind of blood is to be found in

(*a*) The left ventricle.
(*b*) Pulmonary artery.
(*c*) Right auricle.

PAPER XV.

I. Describe the circulation of the blood.

II. Describe the method and the points at which you would apply digital pressure to the large arteries of the arm and leg.

III. In a case of insensibility, by what signs would you recognise which of the following conditions it was due to :—

(*a*) Alcoholism?

(*b*) Poisoning by laudanum?

(*c*) Apoplexy?

IV. What are the main points to attend to in carrying a patient with a fractured leg on a stretcher? How would you extemporise a stretcher?

PAPER XVI.

I. Give the signs and treatment of

(*a*) A broken thigh-bone.

(*b*) A fracture of the base of the skull.

II. Give the signs by which you would recognise an epileptic from an apoplectic fit.

III. What points distinguish arterial from venous bleeding?

IV. What is a styptic? Mention the most important ones, and state how they are to be used.

V. Poisoning by oil of vitriol—To what class of poisons does this belong? Give its signs and "first aid" treatment.

PAPER XVII.

Time — One Hour.

State what you know about

(1) The heart and circulation of the blood.

(2) Arterial hæmorrhage, and its treatment.

(3) Fractures of the forearm, and their treatment.

(4) Apoplexy, and its treatment.

(5) The methods of preparing splints and stretchers.

PAPER XVIII.

Time — One Hour.

State what you know about

(1) The nervous system.

(2) Burns, and their treatment.

(3) Fracture of the collar bone, and its treatment.

(4) Opium poisoning, and its treatment.

(5) Bed-sores, and their treatment.

PAPER XIX. (FOR JUNIOR CLASS).

I. State the points of difference between arterial, venous, and capillary bleeding. Give the lines of the large arteries of the arm and forearm. How would you treat bleeding from a forearm artery?

How would you make temporary splints for a broken leg? What are the signs of a broken bone?

III. Give shortly the treatment of a bad scald of hand.

IV. What is the "first aid" treatment of a fainting fit?

PAPER XX.

I. State what you know about the skull and its contents.

II. What is meant by artificial respiration? how is it carried out, and in what cases is it of service?

III. What examination would you make in order to determine the condition from which the patient is suffering in the following cases:—

(*a*) A young man is thrown from a gig, and falls upon his right hand, which is outstretched to break the fall. He is found supporting the right elbow with his left hand, and his right arm is disabled.

(*b*) A gentleman, aged 70, suddenly becomes unconscious, and falls down in the street. You find his breathing to be slow and deep, and his pulse normal in rate, and strong.

(*c*) A young man, known to have been depressed and melancholic for some weeks, is found lying unconscious in bed. An empty bottle, marked "poison," is found in his bedroom.

IV. Give the "first aid" treatment for the following:—

(*a*) A severe burn of the hand.

(*b*) A fainting fit.

(*c*) A compound fracture of the forearm.

(*d*) Hæmorrhage from—

(1) A cut femoral artery.

(2) A burst varicose vein of leg.

(3) A cut-throat wound.

V. Describe in detail the methods of removing foreign bodies from the eye.

PRACTICAL EXAMINATIONS IN BANDAGING.

(A) Apply the following with the triangular bandage :—

(*a*) Bandages and splints for fractured forearm.
(*b*) A chest bandage.
(*c*) Shoulder bandage.

(B) Apply the following :—

(*a*) A tourniquet on the brachial artery.
(*b*) A bandage for a fractured lower jaw.
(*c*) A large arm sling.

(C) Apply the following :—

(*a*) A bandage for wound of palm of hand.
(*b*) An elbow bandage.
(*c*) A small arm sling.

(D) Apply the following :—

(*a*) Bandage for fractured collar bone.
(*b*) Head bandage (capeline).
(*c*) Large arm sling.

(E) Apply the following :—

(*a*) A bandage to cover the shoulder.
(*b*) A bandage to take in the foot.
(*c*) A tourniquet to arrest absorption from a poisoned bite of the hand.

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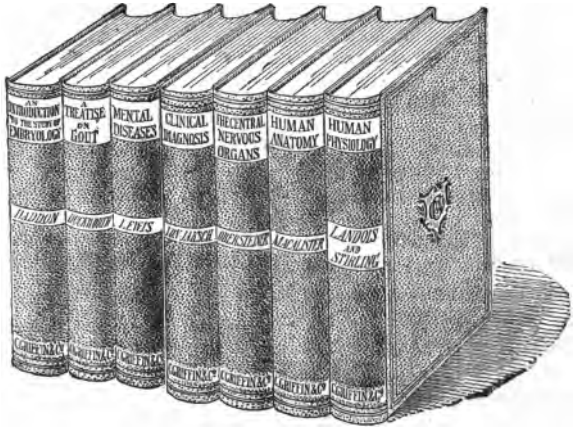

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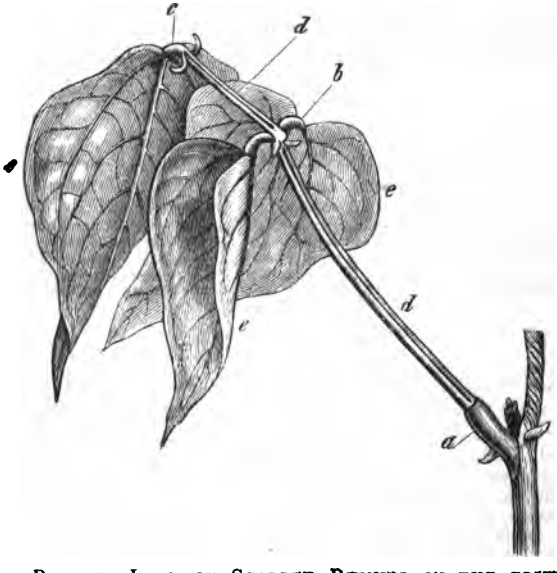

Fig. 109.—PINNATE LEAF OF SCARLET RUNNER IN THE POSITION OF "SLEEP" (from *Sachs*). (Specimen of the Illustrations in Prof. Ainsworth Davis' Biology: Part I.)

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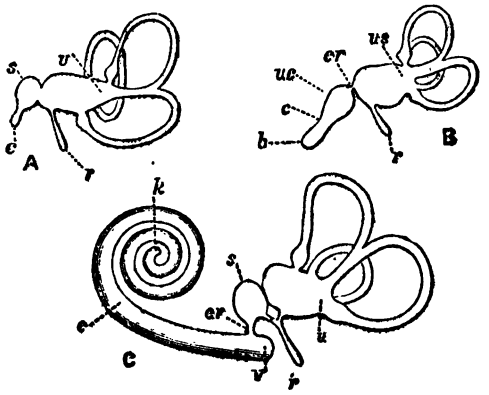

Fig. 72.—DIAGRAMS OF THE MEMBRANOUS LABYRINTH (from *Haddon*). Internal side of left labyrinth.—*A*, Fish. *B*, Bird. *C*, Mammal. (Specimen of the Illustrations in Prof. Ainsworth Davis' Biology: Part II.)

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